BUILDING A DIVERSE HEALTH PROFESSIONS WORKFORCE? CHANGES IN ENROLLMENT AND COMPLETION AMONG UNDERSERVED POPULATIONS IN GRANT SUPPORTED HEALTH PROFESSIONS PATHWAYS

BY

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DISSERTATION

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Abstract

Disparities in the representation of minoritized populations in health professions is a rising concern for educators, scholars, and policy makers (Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004; The Sullivan Commission, 2004). This reflects growing evidence of the relationships among utilization of healthcare, patient outcomes, and the diversity of health professionals at healthcare institutions (Crowley, 2010; Chevannes, 2002; U.S. Commission on Civil Rights, 2010; Williams et al., 2014). Additionally, researchers have found that health professionals from underserved populations are more likely to provide care for medically underserved populations, who in turn are more likely to seek care from providers who have the same racial and ethnic background as themselves (Balogun, Sloan, & Hardney, 2005; Brown et al., 2005; Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004; Smedley et al., 2004).

The courts, researchers, and policy makers at the federal level have advocated for strategic action to improve representations and diversity in health professions (Baldwin, et al., 2006; Blagg & Blagg, 2008; Brown, DeCorse-Johnson, Irving-Ray, & Wu, 2005; Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004; Smedley et al., 2004). Most of the effort to improve equity in health professions have focused on expanding representation of underserved subgroups in health professions education (Blagg & Blagg, 2008). At the same time, health professions educators are being called on to meet a rapidly growing demand for more graduates across most health occupations (Carnevale, Smith, Gulish, & Beach, 2012). As a result, health professions educators are charged with both increasing the supply and diversity of health professionals by engaging

underserved populations in health professions education (Blagg & Blagg, 2008; Smedley, Butler, & Bristow, 2004). While efforts to increase the supply and diversity of health professionals through health professions education have had limited success, the question remains do significant federal human capital investments in health professions education contribute to diversity among health professionals (Carnevale et al., 2012; Smedley et al., 2004).

Human capital theory posits that investments in human capital, including those that support education, result in positive returns for both individuals and society (Sweetland, 1996). In addition to the economic benefits there are numerous other benefits associated with human capital investments including: a) improved health (Belfield & Bailey, 2011; Hout, 2012), b) improved access to healthcare and health insurance (Baum et al., 2013), c) improved civic engagement including a higher propensity to vote (Baum et al., 2013), d) increased tax revenues (Baum et al., 2013, Economic Modeling Specialists International, 2014), job security and stability, e) reduced reliance on unemployment (Economic Modeling Specialists International, 2014; Hout, 2012), f) healthier behaviors (Baum et al., 2013; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014), g) reduced criminal involvement (Belfield & Bailey, 2011, Economic Modeling Specialists International, 2014), h) reduced use of illicit drugs (Economic Modeling Specialists International, 2014), i) reduced reliance on welfare (Baum et al., 2013; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014), and j) and improved socioeconomic standing (Baum et al., 2013; Organisation for Economic Co-operation and Development, 2013). Moreover it is argued that when human capital investments are made in underserved populations they have the highest potential for economic and social returns (Becker, 1971; Levin 2008).

Human capital investments in underserved populations are argued to provide the means for socioeconomic mobility for those directly and indirectly impacted by the investment, including their children and future generations (Becker, 1964; Heckman & Krueger, 2005; Levin 1989, 2008). Levin (2008) contends that the federal government has a strong interest in promoting both the economic benefits and diverse society that are associated with human capital investments. Towards this end, the federal government invests in human capital investments in the form of federal grants that are intended to build a more diverse workforce and improve economic mobility (Levin, 2008). Based on the assertions of human capital theory, researchers have argued that there is a moral and economic imperative that strongly supports federal investments in education that build access and promote successful educational outcomes for underserved student populations (Heckman & Krueger, 2003; Levin, 2008, Levin, Belfield, Muenning, & Rouse, 2007).

This study examined one case of a federal human capital investment in health professions education for evidence of a changes in educational equity for underserved student subgroups. Specifically, this study compared enrollment and educational outcomes of students in health professions programs of study in a consortium of community colleges before and after they received a $19.6 million Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant. This was done by comparing characteristics of a sample of students were enrolled at H2P colleges prior to receiving TAACCCT funding with a sample of students who were enrolled at H2P colleges in TAACCCT-funded programs of study. The first sample, referred to as the comparison sample, consisted of 8,673 students who enrolled in health professions programs of study in 2008 or 2009 at H2P colleges. The second sample, referred to as the participant sample consisted of 4,693 students who enrolled in TAACCCT-funded

programs of study in 2012. Both samples were drawn from eight of the nine H2P colleges. The ninth college was excluded from the study because a comparison sample was not available. The study compares the demographics of students in the two samples, as well as their retention and awarded credentials over a three year period (2008 - 2010, 2009 - 2011 and 2012 - 2014). Underserved populations in health professions programs of study included in this study were: a) Latino students, b) Black students, c) low-income students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. This study addresses the following research question:

Were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges?

a. What changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding?
b. What changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding?

This study utilized two sources of secondary data. The first data source utilized in this study were data gathered by the OCCRL for their third party evaluation of H2P. The OCCRL data included a database of student record data on student demographics, course history, and credentials awarded by the college. Most of the data required for this study were part of this student record database. OCCRL collected data on the health professions programs of study at each H2P college, including those not impacted by TAACCCT funding. This data was used in assigning program length. The second data source utilized in this study are disaggregated

enrollment data reported by H2P colleges in their *IPEDS 12-Month Enrollment* reports. IPEDS data was used in the analysis of enrollment at H2P colleges using Bensimon et al.'s (2003) Equity Index and chi-square analysis, for the following subgroups: a) Latino students, b) Black students, and c) male students.

There were three stages of data analysis used in this study. The first stage was an examination of the enrollment of the two samples in comparison to the populations served at each H2P college. Bensimon et al's (2003) Equity Index was used to calculate the proportion of Latino, Black, and male students in each sample as compared to the college-wide enrollment at the college and consortium level. The second stage of analysis used both Equity Indexes and goodness-of-fit chi-square analysis to compare the composition of the two samples. In this stage Equity Indexes were used to compare the proportion of the Latino, Black, and male students in the two samples. Chi-square analysis were used to compare the composition of each of the students in each of the subgroups featured in this study including: a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. The final stage of analysis used logistic regression to analyze the likelihood of students in each underserved subgroup being retained or completing their program of study. The outcomes examined for each subgroup in the study were: a) retained without a credential, b) awarded one or more certificates, c) awarded one or more associate's degrees, and d) awarded one or more credentials. A logistic regression analysis was run for each sample, for each outcomes, that analysis the relative likelihood of each subgroup reaching the outcome. This analysis was done at the consortium level using a fixed-effect technique to account for the variance among colleges.

This study is dedicated to every student who is part of an underserved population, both those included and not included in this study, who enrolled in and persevered in a Health Professions Pathways health professions program of study. You are an inspiration to so many, including me.

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Perhaps it is obvious, but my gratitude goes first to the dedicated individuals that made envisioned, wrote, implemented, and evaluated the Health Professions Pathways (H2P) consortium. Specifically, I want to thank Dr. Marianne Krismer, the National Director of H2P. Throughout her administration of the TAACCCT grant, Dr. Krismer was actively engaged in the evaluation of H2P, a cheerleader for the utilization and development of evidence-based practices, and for systematic improvement of programs of study to build educational equity and diversity in health professions. The reality, in my humble observation, leadership across H2P embraced the evaluation as an opportunity to learn and improve their practice; welcoming both honest criticism and compliments with equal enthusiasm. Their diligent efforts were key to the development of the OCCRL H2P evaluation database, without which this study would not be possible. The database was developed in collaboration with the H2P evaluation team at the Office of Community College Research and Leadership (OCCRL). Over a dozen individuals at OCCRL contributed at different levels and at different points to the evaluation, all of whom have my gratitude. Specifically I want to acknowledge Cari Bishop, Dr. Debra Bragg, Katie Bridges, Dr. Matthew Giani, and Laura Schneider each whose significant contributions to the stewardship of the OCCRL H2P evaluation database.

Each member of my committee contributed in their own distinct manner to both this work and my growth as a scholar. First, there is Dr. Debra Bragg, the founding director of the OCCRL and the director of OCCRL's H2P Consortium Evaluation Project. Over the last four years I have worked under her guidance with a team of amazing researchers and evaluators who collectively have awarded me incredible opportunities and guidance. During this time she has masterfully stewarded half a dozen projects each with a scale and scope similar to H2P, projects that were

both innately complex and interwoven with each other. The result of which has been a cascade of research and evaluation products informing policy and practice around programs of study, pathways, transfer, and transformative change; of which this dissertation is only but one minor contribution. As an activist and advocate for social justice, Dr. Eboni Miel Zamani-Gallaher, the Director of the Office of Community College Research and Leadership, is inspiring. Her leadership is a multiplicity of a forthright nature that is honest without brutality, coupled with a keen perception of the value of others and the capability to unlock that potential. Dr. Robinson-Cimpian, an expert in the application of quasi experimental design to the study of educational equity and policy, guided me to recognize that for this study the higher value proposition was in choosing simpler methodologies. Finally, but far from least is Dr. K. Peter Kuchinke, my advisor and the chair of my committee. Dr. Kuchinke engages his students in their scholarship meeting them both where they are and with the highest of expectations. Likewise as an advisor, his approach is a combination of enthusiastic engagement, validation, and the strongest encouragement to continuously strive for the highest level of scholarship and growth. For me, Dr. Kuchinke's passion for workforce education and human development, provided a beacon in a field that can sometimes feel dominated by corporate focused strategy, training and development.

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part in because of my daughters. May they be inspired to pursue their dreams, unlock their passions, and craft their unique contribution in this busy, beautiful, and demanding world.

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Introduction

An equity agenda is held by many who are connected to the educational system including policy makers, faculty, staff, administrators, industry representatives, evaluators, and researchers who are actively working to improve educational equity for all students (Barbara, 2010). Educators working for educational equity envision an educational system where students' outcomes are not predictable based on factors that do not represent the students' experiences, skills, ability, knowledge, or character such as their race, gender, or socioeconomic status (Levin, 1994). Levin (1994) provided the following eloquent but simple criterion for measuring educational equity: "A reasonable criterion is that we have obtained educational equity when representatives of different racial, gender, and socioeconomic origins have about the same probabilities of reaching different educational outcomes (pp. 168)."

Approaches to building educational equity include strategies to effect incremental changes and transformative changes to educational policies, processes, or practices in order to reduce disparities between different student populations. These efforts often focus on reducing barriers to access to educational opportunity or reducing disparities in educational outcomes among different subgroups of students. Access is critical because educational equity cannot be achieved if populations are indirectly or directly excluded from participating in higher education (Bensimon, 2004). However, access alone is not sufficient because educational equity also requires that underserved students receive the opportunities and supports necessary to successfully reach their goals (Barbara, 2010; Bragg, 2001).

Efforts to build educational equity require change agents to recognize, acknowledge, and actively respond to disparate effects of discrimination that occur both within and external to the educational system (Bensimon & Harris, 2012; Dowd & Bensimon, 2015). This discrimination

includes both intentional and unintentional disparate treatment that disadvantages a group on the basis of inadequately justified factors such as race, ethnicity, and socioeconomic status (Blank, Dabady, & Citro 2004). Discrimination includes intentional and unintentional actions of individuals, as well as discrimination that is embedded within systems, organizational structures, and routine processes (Becker, 1971; Dowd & Bensimon, 2015). Discrimination and the effects of discrimination extend beyond the educational system, interacting with and adding to discrimination in other areas of students' lives (e.g. housing, healthcare, lending, criminal system, and employment) (Blank et al., 2004). Because of discrimination and other disparities in support and opportunities that exist both within and outside of the educational system, students within different subgroups may require differentiated resources, supports, and services to access and persist in educational programs. For this reason, the provision of the same resources, supports, and services to all students; is unlikely to lead to educational equity.

The nation's confidence in the potential of education to impact equity is reflected in a long history of federal investments in educational initiatives aimed at both building economic growth for the nation and providing opportunities for low-skilled, low-income, or dislocated workers, and other underserved populations. These federal investments include programs funded through the Carl D. Perkins Career and Technical Education Act, Workforce Investment Act Title I and Title II, Trade Adjustment Assistance Act, Higher Education Act of 1965 (TRIO and Pell Grants), and the National Apprenticeship Act. The expected relationship between human capital investments in education, economic growth, and a more equitable society are also reflected in investments in educational initiatives supported by state and private foundations (Fox, 2015).

The nation's confidence is supported by scholars who posit that investments in human capital, especially those that target underserved populations, serve as a catalyst for supporting "a democratic society moving gradually toward the achievement of human goals including social justice, a more fulfilling life for all citizens, and the acceptance of diversity" (Hurn, 1993, p. 46). These scholars posit that human capital investments in educational access and achievement of underserved populations provide these populations a means for socioeconomic mobility that is expected to result not just in a growth in educational equity but also in a more equitable and diverse society (Becker, 1964, 1971; Levin 1989, 2008). Further, they argue that federal human capital investments in underserved populations result in improved economic conditions for the targeted individuals, positive returns on the investment for society, and improved equity for target populations (Becker, 1964; Heckman & Krueger, 2005; Levin 2008). They posit that human capital investments in education reduce societal costs associated with disparities in educational access and achievement, including reduced productivity, higher healthcare costs, lost tax revenue, higher rates of criminalization, higher unemployment costs, and a higher reliance on private and government social services (Baum, Ma, & Payea, 2013; Becker 1993; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014; Hout, 2012; Levin 1989, 2008; Organisation for Economic Co-operation and Development, 2013; Rosenberg, 1992).

Problem Statement

While there are disparities in the representation of minoritized populations across many industries, there is a growing awareness that there are relationships between utilization of healthcare, patient outcomes, and the diversity of health professionals at healthcare institutions (Crowley, 2010; Chevannes, 2002; U.S. Commission on Civil Rights, 2010;

Williams et al., 2014). This growing awareness has fostered efforts to build a more diverse body of health professionals. These efforts have primarily focused on improving educational equity in health professions education (Blagg & Blagg, 2008). At the same time, there is a call to increase the overall number of health professionals in order to meet the rapidly growing demand across most health occupations (Carnevale, Smith, Gulish, & Beach, 2012). Carnevale et al., (2012) estimate that between 2010 and 2020 there will be 5.6 million job openings in health occupations. In addition, current projections show anticipated shortages in most health professions as the growing demand is outpacing the supply of qualified workers (Carnevale et al., 2012; Crowley, 2010; Melillo, Dowling, Abdallah, Findeisen, & Knight, 2013; Price-Glynn & Rakovski, 2012; Smedley et al., 2003; U.S. Commission on Civil Rights, 2010). As a result, efforts to increase diversity of health professionals have been coupled with a larger effort to expand the number of health professionals trained (Blagg & Blagg, 2008; Smedley, Butler, & Bristow, 2004).

While there have been gains in representation for specific populations in a few health occupations, notable gender, race, and ethnic disparities remain across most health occupations (Carnevale et al., 2012). Most health professions, including nursing, technical, administrative, and support professions, are predominately female; whereas; some of the highest paying health professions including physicians, optometrists, chiropractors, dentists, and emergency medical technicians, are predominately male (Carnevale et al., 2012; The National Center for Health Workforce Analysis, 2015; Smedley et al., 2004). While Black individuals are underrepresented in the majority of health occupations, they are overrepresented in low-paying, entry-level health support occupations, as well as in vocational nursing (The National Center for Health Workforce Analysis, 2015). Likewise, with the exception of dental assistants, personal care aides, medical

assistants, and other health support occupations, Latinos are underrepresented in health occupations (The National Center for Health Workforce Analysis, 2015).

Low-income individuals are underserved both by the healthcare system and in health professions education. For example, despite having higher rates of chronic illness and being overall less healthy than those living above the federal poverty level, adults living in poverty are both less likely to be seen by a doctor and more likely to deter or delay medical treatments, including taking prescribed medications, due to cost (Crowley, 2010; Kaiser Commission on Medicaid and the Uninsured, 2009). Individuals living in poverty are also more likely to be uninsured or underinsured (Raiz, 2006; Kaiser Commission on Medicaid and the Underinsured, 2009). Whereas substantial research has explored disparities for low-income patients, less is known about the enrollment and educational outcomes of low-income health professions students participating in and graduating from health professions programs. What is known is that tuition costs have grown and that there has been a reduction in need based aid available to students (Crowley, 2010; Smedley et al., 2004). These changes have resulted in a high level of unmet need that impacts both access and retention for low-income health-professions students (Baldwin et al., 2006; Crowley, 2010; Smedley et al., 2004).

Much of the research highlighting issues of inequity in the populations participating in health-professions education and among health occupations focuses on highly-selective programs such as those for physicians, physician assistants, nursing, and dentistry. Researchers highlight how combined Black and Latino populations account for less than 10% of each of these occupations, despite representing nearly a quarter of the adult population in the United States (Grumbach & Mendoza, 2008; The Sullivan Commission, 2004). With the exception of nursing, the programs associated with these occupations are predominately bachelor-or graduate-level

programs. There are nursing programs at both the associate and baccalaureate levels. While addressing disparities in the programs highlighted in these studies is important for addressing equity in healthcare, it is also important to note that disparities are pervasive throughout health occupations.

Purpose Statement

The Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program provides an excellent opportunity to examine the impact of a federal investment in human capital on educational equity in a consortium of colleges focused on innovating their health professions programs of study. As part of the Health Care and Education Reconciliation Act of 2010, nearly $2 billion was allocated for the TAACCCT grant program in a nationwide effort to build human capital (Reconciliation Act, Public Law No. 111-152, 19 USC 2372 2372a). TAACCCT funding was distributed in four annual rounds between 2010 and 2014 to individual community colleges and consortia of community colleges to develop and enhance innovative short-term vocational education and career training programs of study at community colleges that are two-years or less and that result in high-wage, high-skilled jobs in advanced manufacturing, transportation, healthcare, and STEM occupations (U.S. Department of Labor, 2013). The Department of Labor awarded a total of 256 TAACCCT grants involving over 800 educational institutions, who were primarily community colleges, across all 50 states (U.S. Department of Labor, n.d.-b; Martin, 2015). While awards ranged from $2.5 million to $25 million, more than half of the grants awarded were between $2.5 and $5 million (Eyster, 2015, U.S. Department of Labor, 2014).

The Department of Labor priorities for round one of TAACCCT funding included a) accelerating progress for low-skilled and other workers; b) improving retention and achievement rates to reduce time to completion; c) building programs that meet industry needs, including developing career pathways; and d) strengthening online- and technology-enabled learning (U.S. Department of Labor, 2011, p. 5).

The largest number of awards in round one, 27 of the 49 total round one awards, were awarded for projects that focused on the health professions education (U.S. Department of Labor, 2012). Over the four-year period, there were 90 awards to consortium and individual colleges whose funded projects focused on the health professions education (Martin, 2015). Most of the awards granted went to projects that focused on one of the following six industries that are listed in order by number of grants awarded 1) manufacturing, 2) healthcare, 3) information technology, 4) transportation and logistics, 5) energy, and 6) agriculture (Martin, 2015).

One of the largest of TAACCCT grants awarded in 2011, that focused on healthcare, was a $19.6 million grant awarded to Cincinnati State Technical and Community College in Cincinnati, Ohio, to lead Health Professions Pathways (H2P). The H2P grant was initiated on October 1, 2011, with a grant period of 36 months that was extended through September 30, 2015, through a one-year no-cost extension. H2P was a national consortium of nine colleges, in seven states, that focused on the development and enhancement of programs within the healthcare industry. H2P used TAACCCT funding to enhance and develop a total of 41 health professions programs of study. The nine colleges that made up H2P were selected to represent a spectrum of campus sizes, and all had a shared commitment “to galvanize a national movement to dramatically redesign and enhance health professions education and training through national curricular reform, industry engagement, innovative practices and programs, and

intensive usage of data and accountability systems to ensure student success and program excellence" (Cincinnati State Technical and Community College, 2011). The co-grantee colleges that made up H2P include:

- Anoka-Ramsey Community College (ARCC), Coon Rapids, MN,
- Ashland Community and Technical College (ACTC), Ashland, KY,
- Cincinnati State Technical and Community College (CSTCC), Cincinnati, OH,
- El Centro College (ECC), Dallas, TX,
- Jefferson Community and Technical College (JCTC), Louisville, KY,
- Malcolm X College (MXC), City Colleges of Chicago, Chicago, IL,
- Owens Community College (OCC), Perrysburg, OH,
- Pine Technical and Community College (PTCC), Pine City, MN,
- Texarkana College (TXC), Texarkana, TX.

Research Question

This study examines the enrollment and educational outcomes of underserved student subgroups in H2P colleges' health professions programs of study before and after receiving TAACCCT funding. Specifically, the study compares a comparison sample of students who enrolled in either 2008 or 2009, before TAACCCT grant funds were awarded, with a participant sample of students who enrolled TAACCCT impacted programs of study at H2P colleges in 2012. The study compares the demographics of students in the two samples, as well as their retention and program completion over a three year period (2008 - 2010, 2009 - 2011 and 2012 - 2014). Changes that positively or negatively impacted populations underserved in health professions education, and their implications are discussed. Underserved populations examined

in this study include students who are: a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. This study addresses the following research question:

> Were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges?
>
> a. What changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding?
> b. What changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding?

Theoretical Framework

Human capital theory (HCT) asserts that individuals and society derive economic and societal benefits from investments in people (Becker, 1993; Sweetland, 1996). These human capital investments include investments in health and human services, as well as informal, on-the-job, and formal education (Schultz, 1961). Mincer (1958), an economist, empirically demonstrated a relationship between individuals' human capital and their income, where he used the amount of training required for an occupation as a proxy for skill level, and he used the number of years employed and age as a proxy for experience. In 1964, Becker expanded on Mincer's work demonstrating societal economic benefit in addition to the individual benefit of investments in human capital, with an emphasis on education (Sweetland, 1996). Building on the

work of Becker and Mincer, economists have demonstrated repeatedly the relationship between investment in higher education and individual, as well as societal economic gains (Sweetland, 1996).

HCT is a functionalist theory that is directly in line with the policy goals of societal economic gain and building an equitable democracy associated with vocational education and career training (Dadgar & Weiss, 2012; Goldstein, Lowe, & Donegan, 2012; Hurn, 1993; Maguire, Starobin, Laanan, & Friedel, 2012; Stone, 2014). HCT closely reflects a deeply seated cultural belief, that "pursuit of education leads to individual and national growth" (Sweetland, 1996, p. 356). It has been repeatedly argued that a country's economic standing is heavily reliant on access to a) natural resources, b) capital and technology, and c) human capital (Baum et al., 2013; Gray & Herr, 1998; Hout, 2012). While researchers' ability to establish causation in the complex economics associated with education is limited, a variety of outcomes have been shown to strongly correlate with gains in educational achievement. These include increased income and tax revenues; increased job security and stability; healthier behaviors and better access to healthcare; improved morale; reduced criminalization; reduced reliance on welfare; improved civic engagement; and improved socioeconomic standing (Baum et al., 2013; Beder, 1989; Belfield & Bailey, 2011; Dougherty & Townsend, 2006; Dowd, 2003; Economic Modeling Specialists International, 2014; Hout, 2012; Organisation for Economic Co-operation and Development, 2013; Rosenberg, 1992).

Human capital theorists argue that investments in human capital, especially education, are key to building a more equitable and just society (Baum et al., 2013; Becker, 1993; Psacharopoulos, 2006). They posit that investments in human capital targeted at underserved populations create opportunities for socioeconomic mobility for current and future generations

(Baum et al., 2013, Becker, 1993; Psacharopoulos, 2006). Further, they argue that investments in underserved populations have the highest potential for economic and social returns (Becker, 1971; Levin 2008). Additionally, Becker (1971) demonstrated that higher gains can be anticipated when disparities in the gains from human capital investments that stem from intentional, unintentional, and systematic acts of discrimination are minimized. In turn, a more equitable society will see greater overall returns from investments in human capital (Becker, 1971; Levin, 2008). Based on the assertions of human capital theory, researchers have argued that there is a moral and economic imperative that strongly supports federal investments in education that build access and promote successful educational outcomes for underserved student populations (Heckman & Krueger, 2003; Levin, 2008; Levin, Belfield, Muenning, & Rouse, 2007).

Significance

This study provides insight into how a federal investment impacted educational equity for underserved populations in health professions programs of study in a consortium of nine colleges. However, this study is not an evaluation of TAACCCT. While there are themes of improving educational opportunity for displaced and underserved populations in the TAACCCT solicitation for grant application, this is not the primary intended effect of the grant program. This information is useful first and foremost to the H2P Consortium and co-grantee colleges, whose work was reflected in this study. This study provides the consortium and colleges with information that illustrates areas where progress was made towards educational equity, and the extent of that progress, as well as highlighting areas of educational inequity. This information is also important for the H2P consortia that through its relationships with other TAACCCT-funded

consortium, colleges, and partners, as the consortium and its partners continue their work on galvanizing a national movement focused on reforming health professions education.

The intended audiences for this study include researchers, evaluators, policy makers, college administration and faculty who administer or teach health professions education and other vocational education and career training programs at community colleges. For researchers and evaluators, this study is intended to contribute to our collective understanding of the impact of federal investments on educational equity in community college programs, especially within the health professions. At the policy level, this study is intended to encourage policy makers to examine the impact of vocational education and career training policies and grant funding on educational equity. The intent is for this information to help policy makers better support initiatives that take an active role in evaluating and contributing to educational equity for all students.

Definition of Terms

Allied health professionals. The segment of the health professions workforce that delivers service involving the identification, evaluation and prevention of diseases and disorders; dietary and nutrition services; and rehabilitation and health systems management (Association of Schools of Allied Health Professions, 2014, p. 1). Allied health professionals include dental hygienists, diagnostic medical sonographers, dietitians, medical technologists, occupational therapists, physical therapists, radiographers, respiratory therapists, and speech language pathologists. Physicians, nurses, dentists, and pharmacists are not allied health professionals.

Contextualized developmental education. A diverse family of instructional strategies designed to more seamlessly link the learning of foundational skills and academic or

occupational content by focusing teaching and learning squarely on concrete applications in a specific context that is of interest to the student (Mazzeo et al., 2003, pp. 3 – 4).

Discrimination. Discrimination is defined by the National Research Council's Panel for Methods for Assessing Discrimination (Blank, Dababy, & Citro, 2004) as the intentional or unintentional disparate treatment and disparate impact that disadvantages a group on the basis of inadequately justified factors such as race, ethnicity, and socioeconomic status.

Educational equity. Educational equity is an educational and societal ideal under which students' educational outcomes are not predictable based on factors that do not represent the students' experiences, skills, ability, knowledge or character such as their race, gender, or socioeconomic status (Levin, 1994).

Equity Index. The Equity Index is a measure of proportionality based on the population for each group under analysis that results in a standardized score that is indicator specific, population specific, and year specific (Bensimon et al., 2003). The Equity Index allows for the comparison of the enrollment and outcomes for each demographic subgroup.

Health occupations core curriculum. A set of interdisciplinary courses, clinical training, and other educational exposures designed to provide allied health students at each level with the common knowledge, skills, and values necessary to perform effectively in the evolving health care workplace. (McPherson, 2004, p. 30)

Human capital. Human capital is the combination of innate and acquired knowledge, skills, and abilities that are held by an individual. Innate abilities are genetic and are fixed; however, acquired abilities are variable and reflect environmental supports and investments that have been made in the individual including education, health, and human services (Schultz, 1993).

Industry-recognized credential. Industry-recognized credentials are a credential that either was developed and offered by or endorsed by a nationally-recognized industry association or organization representing a sizeable portion of the industry sector, or a credential that was sought or accepted by companies within the industry sector for purposes of hiring or recruitment which may include credentials from vendors of certain products (Oates, 2010, p. 6).

Minoritized. This term is used in this study in favor over the term minority. As noted by Dowd and Bensimon (2015), "certain groups acquire minority status through the beliefs and social processes enacted by other groups who place them in a position of the 'minority,' the 'other'" (p. 8).

Nontraditional-aged students. This proposal adopts the Advisory Committee on Student Financial Assistance's (2012) to categorize students by age as traditionally aged students and nontraditional-aged students. According to the Advisory Committee on Student Financial Assistance (2012), nontraditional-aged students are "any student who fails to fit the traditional student template, which generally refers to an 18- to 24-year-old full-time college student" (p. 3). Specifically, nontraditional-aged students are students who are 25 years of age or older.

Prior learning assessments. Prior learning assessments are the process by which many colleges evaluate for academic credit the college-level knowledge and skills an individual has gained outside of the classroom (or from non-college instructional programs), including employment, military training/service, travel, hobbies, civic activities and volunteer service (CAEL, 2010, p. 6).

Stackable credentials. Stackable credentials are a part of sequence of credentials that can be accumulated over time to build up an individual's qualifications and help them to move along a career pathway or up a career ladder to different and potentially higher-paying jobs. For

example, one can stack a high school diploma, an associate's degree, and then typically obtain two more years of appropriate postsecondary education to obtain a bachelor's degree. An individual can also stack an interim career/work readiness or pre-apprenticeship certificate, then complete an apprenticeship, and later earn a degree or advanced certification (Oates, 2010, p. 6 - 7).

Underserved students. Underserved students are those who have been historically underrepresented by higher education (Taylor, 2013). This proposal adopts the Advisory Committee on Student Financial Assistance's (2012) definition of a nontraditional student:

> Any student who fails to fit the traditional student template, which generally refers to an 18- to 24-year-old full-time college student. Among the students included in the nontraditional definition are not only older students, but students who may face additional challenges or barriers, e.g., foster youth, veterans, men and women on active duty, and first-generation college students. (p. 3)

The term underserved students is used preferentially over that of nontraditional students in this proposal because the term highlights the fact that these populations have been historically underserved by the educational system (Bragg, 2013). The term underserved, "acknowledges that at least as much responsibility for the lack of the students' college enrollment rests with the higher education system as with the students themselves" (Bragg, 2013, p. 35).

Literature Review

This review is organized in five sections. First is a description of the guiding theory for this study, human capital theory (HCT). This description highlights work by Becker who used human capital theory to examine issues of equity and market discrimination and Levin who argues that federal human capital investment can build equity. The second section highlights the role of community colleges in serving underserved student populations and promoting educational equity. The third section is a brief overview of vocational education and career training in community colleges with a focus on program completion and employment. The fourth section focuses on underserved populations of students and graduates. The final section highlights the significance of inequitable representation in health occupations.

Human Capital Theory

Human capital is the combination of innate and acquired knowledge, skills, and abilities that are held by individuals (Dadgar & Weiss, 2012; Goldstein et al., 2012; Maguire et al., 2012; Stone, 2014). Innate abilities are genetic and are fixed; acquired abilities are variable and reflect environmental supports and investments including education, health, and human services (Schultz, 1993). Human capital investments are investments that extend the productivity of individuals, and include investments in health and human services, as well as informal, on-the-job, and formal education (Becker, 1993; Schultz, 1961). Human Capital Theory (HCT) asserts that individuals and society derive economic benefits from investments in people (Becker, 1994; Mincer, 1958; Sweetland, 1996). HCT as applied to education, posits that an individual's productivity and labor market value is a product of the knowledge, skills, and abilities they have developed through their education and work experiences (Becker, 1993; Sweetland, 1996). Thus,

training and education are theorized to be investments in human capital that have economic rewards for the individual, organization, and country (Becker, 1993). The presumption that there is value in the investment of resources in education is a longstanding fundamental argument for the formalization of the education system. With the development of the HCT Mincer (1958) and Becker (1964) laid the foundation for the empirical study of the relationship between investments made in individuals and the resulting economic benefit. Mincer, an economist, empirically demonstrated a relationship between the skill and experience of an individual and their income. He used the amount of training required for an occupation as a proxy for skill level and years employed and age to determine experience. In 1964, Becker expanded on Mincer's work to include societal economic benefit in addition to the individual benefit of investing in education (Becker, 1993; Sweetland, 1996).

HCT involves seven assertions about the relationship between education and economic benefit. The first assertion is that there are direct costs associated with education, and as such, education involves investment by individuals, organizations, government, or a combination of these sources (Becker, 1993). The second assertion is that there are indirect costs associated with education or training (Psacharopoulos, 2006). These indirect costs are sometimes termed opportunity costs and represent earnings and other economic opportunities that are forgone as a result of time invested in the education process. The third assertion is that there is a return on the investment made in education in terms of increased earnings that are theorized to be a result of increased abilities and productivity (Psacharopoulos, 2006). The fourth assertion is that in conjunction with economic benefits to the individual, educational attainment is associated with other positive outcomes. These outcomes include: a) improved health (Belfield & Bailey, 2011; Hout, 2012); b) improved access to healthcare and health insurance (Baum et al., 2013); c)

improved civic engagement including a higher propensity to vote (Baum et al., 2013); d) increased tax revenues (Baum et al., 2013; Economic Modeling Specialists International, 2014); e) improved job security and stability, and a reduced reliance on unemployment (Economic Modeling Specialists International, 2014; Hout, 2012); f) healthier behaviors (Baum et al., 2013; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014); g) reduced criminal involvement (Belfield & Bailey, 2011, Economic Modeling Specialists International, 2014); h) reduced use of illicit drugs (Economic Modeling Specialists International, 2014); i) reduced reliance on welfare (Baum et al., 2013; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014); and j) improved socioeconomic standing (Baum et al., 2013; Organisation for Economic Co-operation and Development, 2013). The fifth is that investments in human capital promote economic gains for individuals and influence future economic growth for subsequent generations, creating opportunities for socioeconomic mobility (Baum et al., 2013; Becker, 1993; Psacharopoulos, 2006). The sixth is that this return in investment has economic benefit at the individual, organizational, and societal levels (Becker, 1993; Dobbs, Sun, & Roberts, 2008; Sweetland, 1996). The final assertion is that in a perfectly competitive labor market subgroups that are distinguishable only by factors not related to their productivity should have statistically equivalent labor market outcomes (Becker, 1993). If there are statistically significant differences in the employment outcomes among subpopulations who have comparable productivity, the effective difference is attributed to discrimination (Becker, 1971, 1993).

Human capital theorists argue that investments in human capital, especially education, are key to building a more equitable, just, and diverse society (Baum et al., 2013; Becker, 1993; Psacharopoulos, 2006). When these investments are in education of underserved populations,

they serve as the means to promote socioeconomic mobility for current and future generations with high rates of returns for society (Baum et al., 2013; Becker, 1993; Psacharopoulos, 2006). Further, as the margin for change is the highest for underserved populations, investments in these populations have the highest potential economic and social returns (Becker, 1971; Levin 2008). These returns include increased income taxes and productivity and reductions in healthcare costs, crime, unemployment costs, and government assistance (Baum et al., 2013; Becker 1993; Belfield & Bailey, 2011; Economic Modeling Specialists International, 2014; Hout, 2012; Levin, 1989, 2008; Organisation for Economic Co-operation and Development, 2013; Rosenberg, 1992).

It is argued that these societal benefits create a moral and economic imperative to prioritize economic investments to support underserved students populations (Becker, 1993; Levin, 1983, 2008; Levin, Belfield, Muenning, & Rouse, 2007). Therefore, while human capital theory can be used to justify individual investment and returns in education, it is also used to demonstrate how supporting underserved populations is of benefit both to those populations directly impacted and to society as a whole (Becker, 1964; Heckman & Krueger, 2005; Levin, 2008). Based on the assertions of human capital, researchers have argued that there is a moral and economic imperative that strongly supports federal investments in education that build access and promote successful educational outcomes for underserved student populations (Heckman & Krueger, 2003; Levin, 2008; Levin, Belfield, Muenning, & Rouse, 2007).

Levin (1983, 2008), a well-respected economist, has advocated for human capital investment in underserved populations throughout his career. He argues that it is in the nation's interest to ensure that all citizens have equitable educational access and supports, and that when some populations are educationally disadvantaged because of a combination of the

circumstances of their birth and discrimination, it is imperative for the federal government to take action to counter these disadvantages. Further, higher gains can be anticipated when disparities in the gains from human capital investments that stem from intentional, unintentional, and systematic acts of discrimination are minimized (Becker, 1971).

Levin (1983, 2008) asserts that federal educational grants are essential investments in underserved populations that encourage these populations to be fully engaged citizens, promoting a more active democratic and financially stable society. These sentiments are echoed by Levin's contemporaries, including Becker (1964) and Heckman and Krueger (2005). Likewise, the nation's confidence in the potential of education to impact equity can be seen reflected in the federal investment in vocational education and career training initiatives that target low-skilled individuals, low-income individuals, dislocated workers, and other underserved populations including programs funded through the Carl D. Perkins Career and Technical Education Act, Workforce Investment Act Title I and Title II, Trade Adjustment Assistance Act, Higher Education Act of 1965 (TRIO and Pell Grants), and National Apprenticeship Act. This sentiment can be seen reflected in numerous state and privately funded vocational education and career training initiatives (Fox, 2015).

Levin (1983) provides a taxonomy of four types of federal educational grants, identifying categorical grants as the most important for type of federal investment for promoting educational equity. He defines categorical grants as federal grants where financial aid is provided on "behalf of a particular category of services or students" (p. 447). Categorical grants are effective because they rank high on the a) impact to state and local educational expenditures, b) ability to target specific areas of inequity, and c) accountability due to established definitions, regulations, and

guidelines for use. Under Levin's taxonomy of federal grants, the TAACCCT grant program is most closely aligned within this definition of a categorical grant.

Alternative theories. HCT scholars argue that human capital investments result in changes to the students' knowledge, skills, and abilities; and that it is these changes that result in social and economic gains for the individual and society. However, the research that is used to substantiate HCT typically does not measure learning itself, but use credentials or course completion as a proxy for learning in their studies. This has led theorists to debate the role and value of educational credentials awarded and students' employment.

Signaling theory was introduced by Spence, an economist, in the seminal piece on the theory in 1973. Spence argued that there is an economic value inherent to the exchange of information in instances of informational asymmetry. "Informational asymmetries arise between those who hold that information and those who could potentially make a better decision if they had it" (Connelly, Certo, Ireland, & Reutzel, 2011). Spence posited his argument in illustrating that potential employers' lack the necessary information to make good hiring decisions. Potential employees use their education to signal their value as an employee. In addition to indicating the skills and abilities likely held by an individual, research has shown that employers are more likely to perceive educated candidates as being reliable, efficient, and safer on the job (Rosenberg, 1992). In providing this information, potential employees reduce the informational asymmetry.

Critical theorists argue that the educational system in the United States is structurally designed to reinforce social inequalities and to indoctrinate members of society into a cultural bound social class system (Bowles & Gintis, 2002; Brint, 2003; Brint & Karabel, 1989; Clark, 1960; Hurn, 1993). They argue that HCT fails to adequately account for the role of hereditary

and cultural naturalization to social class. For example, Bowles and Gintis (2002) provide a strong, empirically backed argument that social class is transmitted by intergenerational heredity. They argue that education is an indicator of social class, citing the strong correlation between parental educational attainment and subsequent generations' educational attainment (Meyer, 1977). Meyer (1977) argues that education reinforces and legitimizes elite status, allocating authority based on educational status as a more acceptable form of social class. Under both of these theories, the measured economic benefits of education are relative not to the skills and abilities gained through education, but rather to the transfer of cultural capital associated with social class and the transference of class based cultural norms.

Signaling theories and the critical theorists highlighted in this section all point to the importance of credentials in understanding educational equity. HCT and signaling theories are not inherently oppositional, in that HCT is about the gain in skills and abilities, and signaling theory is about the information exchange where a job applicant shares the endorsement of the skills and abilities they have gained through education (Dobbs et al., 2008; Sweetland, 1996). While critical theorists question the existing structures of the educational system, the critical theories highlighted in this section suggest that the social and cultural capital associated with credentials unjustly favors subgroups of privileged students. This highlights the importance of equitable access and attainment as key factors educational equity and in addressing social and economic disparities for minoritized students.

Educational Equity in Community Colleges

Despite the oft-expressed commitment of community colleges to democratization and equity, the effect of community colleges on equity is of exceptional concern for scholars. There

are three recurring criticisms in relation to community colleges. The first is diversification of program and internal mission conflict, coupled with limited resources create inefficiencies in community colleges that reinforce inequities (Dougherty & Townsend, 2006; Dowd, 2003; Harbour, 2015; Goldrick-Rab, 2010; Grubb & Lazerson, 2005; Jacobs & Dougherty, 2006; Levin, 1994; Smedley et al., 2004; Stone, 2014). The second is how the social-political stratification of the educational system and community colleges' position within it reinforce inequalities by diverting students from alternative options (Brint, 2003; Brint & Karabel, 1989). The third is that despite a public commitment to equity, community colleges lack clear frameworks for building accountability for supporting equitable access and outcomes, resulting in systematic barriers to colleges' ability in providing culturally competent education and supports for diverse student populations (Bensimon, 2004; Bragg, 2013; Congleton, 2014; Dowd, 2003; Fox, 2014; Graham, 2013; Hao, 2006; Harris, Bensimon, & Bishop, 2010; Kirby & Fox, 2014).

All of these criticisms reflect a response to the high level of structural inequality in higher education and disproportionate level of resources available to community colleges (Grubb & Lazerson, 2005). These inequities creates systems where the most comprehensive educational institutions serving the student body with the most needs have relatively limited resources to work with (Dougherty & Townsend, 2006). This results in a deleterious effect on community colleges' ability to serve their students and their community, and reinforces the stigmatized position of community colleges within the structural hierarchy of education. Grubb and Lazerson (2005) illustrate the tension between the positive and negative impact community colleges have on equity in stating, "this system has simultaneously opened up college access for millions of

Americans, while it has also allowed for a variety of elite institutions; equity and meritocracy can coexist with the same system" (p. 11).

Rooted in the comprehensive mission of community colleges is the philosophy of promoting a more equitable society through open access to education, allowing students multiple attempts at engaging in education and exploring their interests and abilities, and providing students otherwise excluded from the higher education system opportunities to build skills necessary to be socially and fiscally upwardly mobile (Dougherty & Townsend, 2006; Dowd, 2003; Harbour, 2015). Modest gains to educational equity have been found by examining the populations who are accessing community colleges, much of which can be attributed to the colleges' role in vocational education (Dowd, 2003). However, there is little evidence to support the idea that significant progress has been made towards achieving equitable outcomes for students (Bensimon, 2004; Rupert, 2003, Swail et al., 2003).

At the postsecondary level, analysis of disaggregated data on enrollment and educational outcomes including persistence and completion, can be used to identify inequities, and when combined with inquiry methods, can provide feedback to colleges, funders, and policy makers to improve equity for underserved student populations (Bensimon et al., 2003; Hao, 2006). In response to the limited use of disaggregated data, researchers have developed measures and tools that can be used by colleges, funders, and policy makers to improve equity for all students. The Equity Scorecard (Bensimon, 2004; Bensimon et al., 2003; Hao, 2006) and Pathways to Results (Taylor et al., 2012) are two examples of processes that include tools and resources developed by researchers that use disaggregated data to identify and address systematic inequities impacting underserved populations in education.

This study focuses on educational equity in health professions programs of study. Health sciences is the predominate field in postsecondary vocational and education training. The following section provides an overview of postsecondary vocational and education training highlighting what is known about the prevalence of health sciences, persistence rates, and employment of graduates in these programs.

Postsecondary Vocational Education and Career Training

Community colleges are uniquely situated based on their "organizational flexibility, close proximity to private sector enterprises, low cost, technical expertise, and experience in teaching adult learners," to provide workforce development programs (Jacobs & Dougherty, 2006, p. 53). About 96% of public community and technical colleges offer credit bearing occupational, professional, or technical training programs, and that 61% of community and technical colleges offer not-for-credit occupational, professional, or technical training programs (U.S. Government Accountability Office, 2004). In 2008, there were approximately six million students enrolled in about 30,000 credit bearing postsecondary vocational education programs across 4,000 educational institutions, 68% of whom were enrolled at public community colleges (National Center for Educational Statistics, 2012). Approximately 35% of all students enrolled in public community and technical colleges are enrolled in postsecondary vocational education and career training programs, with the vast majority of these students being in credit bearing programs (U.S. Government Accountability Office, 2004).

Community colleges play a vital role in training health professionals through their postsecondary vocational education and career training. It is estimated that 42% of all health occupations require some college or an associate's degree (Carnevale et al., 2012). Additionally,

community colleges train nearly 50% of the country's nurses (Carnevale et al., 2012). Health science programs are by far the largest segment of vocational and postsecondary vocational education and career training at community colleges. Health sciences account for 43% of all vocational credentials awarded, for a total of 606,899 credentials in 2010-11 (National Center for Education Statistics, 2012), and account for 43% of all subbaccalaureate certificates awarded (Bosworth, 2010). Other notable segments of vocational education and career training include consumer services and business, manufacturing, construction, and transportation, that combined account for 37% of all vocational credentials awarded (National Center for Education Statistics, 2012) and approximately 22% of all subbaccalaureate certificates awarded (Bosworth, 2010). The remaining industries represented in postsecondary vocational education and training include: computer and information services; protective services; engineering, architecture, and science technologies; education; public, legal and social services; and marketing and agriculture, Each of these industries, account for 5% or less of the overall credentials awarded (National Center for Education Statistics, 2012) and less than 5% of all certificates awarded (Bosworth, 2010).

Program completion and employment. The research into labor market gains over the last ten years have evolved substantially and have started to shed light on the connection between the vocational education and career training credentials awarded by community colleges and graduates' employment outcomes. However, there are limited data available on the persistence and employment of students engaged in vocational education and career training programs, especially in relation to disaggregated sub-groups of students and graduates. This is largely due to deficiencies in the both the educational and employment data systematically collected by community colleges, state, and federal agencies (Baldwin, Bensimon, Down, & Klaimen, 2011; Witham, Malcom-Piqueux, Dowd, & Bensimon, 2015). Persistence and labor market returns are

typically aggregated in the literature by credential type, institutional type, or by state. Primarily, this is reflective of the measures available in large national data sets, indicating an area where data critical to understanding vocational education and career training regionally and nationally is not available to researchers (Baldwin et al., 2011; National Center for Education Statistics, 2012). Persistence and labor market returns for students who complete an associate's degree in vocational programs are either comparable to or better than students in associate's degree academic programs (Bailey, Kienzl, & Marcotte, 2004; National Center for Education Statistics, 2012). For example, a National Center for Education Statistics (2012) study examining persistence and credential attainment over a six-year period, starting with the 1995 - 1996 academic year, found that there was no statistically significant variance in persistence and credential attainment between students in associate's level occupational programs and those in associate's level academic degree programs. The persistence rate for students in associate's level occupational programs was 56% with 42% having received a credential (National Center for Education Statistics, 2012). The persistence rate for students in associate's degree level academic programs was 57% with 40% having received a credential (National Center for Education Statistics, 2012).

Overwhelmingly, researchers have found that graduates who earn associate's degrees have positive labor market gains (Belfield & Bailey, 2011; Dadgar & Weiss, 2012; Economic Modeling Specialists International, 2014; Grubb, 2002; Jacobson, LaLonde & Sullivan, 2004, 2005; Jepsen, Troske, & Coomes, 2014; Marcotte, 2010; Marcotte, Bailey, Borkoski, & Kienzl, 2005). Economic Modeling Specialists International (2014) conducted a human capital economic impact analysis that included an analysis of the return on investment for students and taxpayers for the funds invested in community colleges during 2012. They estimated that on average for

every dollar spent by students on their education at a community college they will receive an additional $4.80 in higher future income. Additionally, they estimate that for every dollar spent by taxpayers in 2012 to support community colleges, taxpayers will see a return of $6.80.

The labor market gains earned by graduates vary by career cluster and program of study (Bosworth, 2010; Compton, Laanan, & Starobin, 2010; Dadgar & Weiss, 2012; Maguire et al., 2012; Van Noy & Jacobs, 2009; Van Noy & Weiss, 2010, 2012). With some career clusters offering sequential stackable credentials that lead to increasing labor market returns and other requiring substantial amounts of time before earning an industry recognized credential that can garner positive labor market gains. Labor markets are localized and are notably influenced by the strength of partnerships between the college and regional employers (Goldstein et al., 2012; Grubb, 2002; Van Noy & Weiss, 2010, 2012). As such, individuals with equal human capital can have substantially different earning based on their location, the reputation of the institution they attended, and the relationships the institution has with potential employers.

Labor market returns are commonly examined relative to the length of program of study, where short-term certificates are awarded in programs of study that are less than a year in length and long-term certificates or diplomas are awarded in programs of study that are between one-to-two-years in length (Bosworth, 2010; Dadgar & Weiss, 2012). Bragg, Giani, Fox, Bishop, and Bridges (2015) added an additional category of programs of study, very short-term certificates. These very short-term certificates are programs that result in a credential and consist of 12 or less credits. Examples of very short-term certificate programs include: Certified Nursing Assistant, Phlebotomy, and Trained Medication Aid. Traditionally, very short-term certificates provide specialized training for a single entry-level occupation in a career pathway.

Bosworth (2010) found that in 2008, 54% of the certificates awarded were awarded in programs that were less than one academic year, 42% were awarded in programs that are one year or longer but are less than two academic years in length, and that 4% were awarded in programs longer than two academic years. Economic outcomes for students, who earned long-term certificates have been found to be positive, including an increased likelihood of being employed (Bosworth, 2010; Dadgar & Weiss, 2012; Jepsen et al., 2014). However, these returns may not be significantly different when compared to students with comparable college experience who have not earned a credential (Bailey et al., 2004; Dadgar & Weiss, 2012). The evidence is mixed in regards to labor market gains for students who have earned short-term certificates, with some research showing modest labor market gains (Jepsen et al., 2014) and others reporting minimal to no positive effects (Dadgar & Weiss, 2012). This mixed evidence may be reflecting that there is a high amount of variance among different industries as to the labor market value of short-term certificate credentials (Dadgar & Weiss, 2012). In 2010, an estimated 1,442,187 credentials including 561,730 associate's degrees and 880,457 certificates were awarded in credit bearing career programs by postsecondary institutions (National Center for Education Statistics, 2012).

Certificates are an important aspect of vocational education and training from the perspective of equity. Bosworth (2010) defines certificates as, "credentials issued by educational institutions that indicate completion of a discrete program of study or series of courses" (p. i). Students enrolled in certificate bearing programs of study are more likely to be members of underserved populations than students in associate level programs (National Center for Education Statistics, 2012). Evidence on economic returns for graduates with certificates as compared to students with just a high school diploma, when not disaggregated by length of

program or program of study, are minimal or non-existent (Bailey et al., 2004; Marcotte et al., 2005). Although, when disaggregated by gender, there is evidence that women may see positive economic gain associated with certificates (Bailey et al., 2004). Dadgar and Weiss (2012) found that long-term certificate earners are disproportionately female. The allied health and nursing fields notably influence this representation of females among long-term certificate earners. Of the 953 long-term certificates awarded to students in Dadgar and Weiss's study, 484 of the certificates were in allied health and nursing, with 402 certificates of these being earned by females. It is important to distinguish certificates from certification, the latter being an external industry based credential.

Recently, there have been a few studies that have examined labor market returns by fields of study. Primarily the researchers conducting these studies have utilized fields of study in the Classification of Instructional Programs (CIP) taxonomy to identify and organize their findings. These studies demonstrate that notable differences exist among fields of study, both in the student populations enrolled and labor market returns for graduates (Dadgar & Weiss, 2012; Zeindenberg, Scott, & Belfield, 2015). These studies demonstrated the importance of disaggregating labor market outcomes by field of study, and the need for research to explore the labor market outcomes for graduates within fields of study. An example of the importance of recognizing the value of labor market outcomes at the program of study level was demonstrated by Van Noy and Weiss (2010). Their examination of employment outcomes for graduates from information technology programs of study illustrates the value of examining the question of the evaluating certificate program outcomes at the programs of study level, as they found that students engaging in certificate level programs varied from those in other programs by demographic profile and previous earnings, and that the intent of students enrolling in short-term

certificate programs are different than that of students in long-term certificate or associate's degree programs.

Many of the studies that discuss educational and employment outcomes in postsecondary vocational education and career training highlight differences in the education and employment outcomes among different student populations. These findings provide the basis for scholars understanding of educational equity for underserved populations. The following section defines these underserved populations, discusses the role of community colleges in serving underserved populations, highlight what is known about the education and employment of underserved student subgroups, and discusses the relationship between underserved populations and educational equity.

Underserved Student Populations

Underserved student populations are sometimes referred to as nontraditional or underrepresented student populations. The underserved student population is made up of a large number of overlapping subgroups of students whose background and characteristics separate them from what is viewed as the traditional student (National Center for Education Statistics, 2008). This proposal adopts the Advisory Committee on Student Financial Assistance's (2012) definition of a nontraditional student. The Committee's definition follows:

> any student who fails to fit the traditional student template, which generally refers to an 18- to 24-year-old full-time college student. Among the students included in the nontraditional definition are not only older students, but students who may face additional challenges or barriers, e.g., foster youth, veterans, men and women

on active duty, and first-generation college students. (p. 3)

The term underserved students is used preferentially over that of nontraditional students in this proposal because the term highlights the fact that these populations have been historically underserved by the educational system (Bragg, 2013). The term underserved, "acknowledges that at least as much responsibility for the lack of the students' college enrollment rests with the higher education system as with the students themselves" (Bragg, 2013, p. 35).

Underserved populations and community colleges. Community colleges play an important role in serving and supporting underserved student populations, including low-income students, Black students, and Latino students. The American Association of Community Colleges (2015a) describes community colleges as "centers of educational opportunity" that are "inclusive institutions that welcome all who desire to learn, regardless of wealth, heritage, or previous academic experience" ("About Community Colleges," para. 1). Additionally, the American Association of Community Colleges' (2015b) mission statement affirms a commitment to diversity stating that, "diversity is crucial to a democratic society" (para. 8). Implicit in these statements, is the long-standing ideology that a principle role of community colleges is to expand access and educational opportunities to citizens that will contribute to a more equitable society (Dowd, 2003). With the rising costs of tuition, increased privatization of educational institutions and resources, increasing demands on community colleges to meet a multiplex of missions, and decreased state and federal funding for higher education, the community college's role in promoting access and persistence for underserved populations is of increasing importance in the effort to build an equitable educational

system (Dowd, 2003; Harbour, 2015). There is limited evidence to support the idea that substantial progress has been made toward achieving equitable outcomes for students (Bensimon et al., 2003; Bragg & Durham, 2012; Dowd, 2003; Ruppert, 2003; Swail, Redd, & Perna, 2003).

There were 1,123 community colleges, who served a total of 12.4 million students in fall 2013 (American Association of Community Colleges, 2015b). Among them, 7.4 million students were enrolled in credit programs and 5.0 million in noncredit programs. In the 2012-2013 academic year, community college graduates were awarded 750,399 associate's degrees and 459,073 certificates (American Association of Community Colleges, 2015b). In the 2011-2012 academic year, 72% of community college students received financial aid; a third of this aid came in the form of Pell grants, and 16% came through federal work study programs (American Association of Community Colleges, 2015b). In comparison to baccalaureate students, community college students are more commonly minorities, full-time employed, part-time students, 25 years of age or older, first-generation students, and parents (American Association of Community Colleges, 2015b; National Center for Education Statistics, 2008, 2013). Table 1 shows the percentage distribution of student demographics for full-time students at public institutions for 2013 by institution type (National Center for Education Statistics, 2015).

Table 1
Percentage Distribution of Student Demographics for Full-Time Students by Public Institution Type for 2013

Students Demographics	**2-year Public Postsecondary Institutions (%)**	**4-year Public Postsecondary Institutions (%)**
Age		
Under 25	62	80
15 and older	38	20
Race and Ethnicity		
White	54	62
Black	15	12
Hispanic	22	15
Asian	6	7
Pacific Islander	> 1	> 1
American Indian/Alaska Native	1	1
Two or more races	3	3

Source.
National Center for Education Statistics, 2015

Developmental education students. Expanding engagement with underserved populations requires the development of pathways from developmental education to vocational education and training programs. Developmental education is designed to build the reading, writing, and numeracy skills students' need to successfully engage in college level coursework. In 2001, only 32% of students who graduated from high school were college ready (Green & Foster, 2003).

Students who enroll in vocational education and training represent a wide range of academic preparedness. This reflects, in part, the variation in admission requirements for these programs. While the majority of vocational programs are open access admission, some programs, most notably within the health sciences use a competitive enrollment process (National Center for Education Statistics, 2012). However, there are also vocation and career training programs that do not require entrance exams or that admit students with lower exam

scores than transfer programs at the institution (National Center for Education Statistics, 2012).

Vocational students are more likely to be 30 years old or older (Levesque, Lauen, Teitebaum, Alt, & Librera, 2000). Approximately, one third of adults in the United States have weak numeracy skills and one sixth have low literacy skills (Organisation for Economic Co-operation and Development, 2013). This is reflected in older students, those over the age of 24, having the highest rate of needing developmental coursework among community colleges students (National Center for Education Statistics, 2012). In contrast, there are also as many as 22.6% of students enrolled in vocational programs hold a previously earned degree, and 5.4% of these degree holders hold baccalaureate degrees (Levesque et al., 2000). These students are often highly skilled adult students who are seeking to supplement their skills or reskill, and those interested in changing career pathways (Levesque et al., 2000).

Underserved populations of students are more likely to require basic skills education in order to qualify to participate in college level coursework (Attewell, Lavin, Domina, & Levey, 2006). Over half of minority graduates had initially tested as not academically prepared for college (Attewell et al., 2006). At community colleges, a growing number of the students are either recommended or required to take at least one development course. An estimated 60% of community college students are referred to at least one or more developmental education courses (Bailey & Cho, 2010; Choy, 2000). About 40% of community college students take at least one developmental education course (Attewell et al., 2006). Finally, the need for developmental supports is higher in times of weak economic growth, when low-income students to education to improve their economic situation. Dougherty and Townsend (2006) suggested that in a weakening economy underserved populations enter the higher education system as an “economic safety net,” and that as a result there is an increasing need to provide these students with the

developmental educational supports needed by these students to succeed in their academic study (p. 12).

The literature demonstrates that there is a value to students who participate in and complete developmental education course sequences. Bailey, Jeong, and Cho (2010) found that 27% of the students referred to developmental education courses in math never enrolled in a developmental education course, and 40% of those who did enroll did not complete their developmental education course sequence. Among the students who completed their mathematics developmental education course sequence, 63% took a college-level gatekeeper course, and 78% passed that course (Bailey et al., 2010). Bailey et al. compared these outcomes to students who were referred to developmental education in math but did not take developmental education courses. They found that 17% of students in this group took a gatekeeper course and 12% passed.

The patterns around developmental education courses in reading are similar. Here, Bailey et al. (2010) found that 30% of the students referred to developmental education courses in reading never enrolled in a developmental education course, and 24% of those who did enroll did not complete their developmental education course sequence. Among the students who completed their reading developmental education course sequence, 72% took a college-level gatekeeper course, and 75% passed that course (Bailey et al., 2010). Bailey et al. compared these outcomes to students who were referred to developmental education in reading but did not take developmental education courses. They found that 45% of these students took a gatekeeper course but just 32% passed. However, Attewell et al. (2006) found that community college students who took developmental education courses were significantly less likely to complete an associate's degree as compared to students who did not take developmental education courses.

Gender. Overall, women in career and technical education programs were more likely to persist and earn an associate's degree; however, studies that looked at male dominated fields found that women had lower persistence rates (Compton, et al. 2010; Maguire et al., 2012). Silverberg, Warner, Fong, and Goodwin (2004) found that women with an associate's degree from vocational programs earned on average 47% more than similar women with only a high school diploma. Men with an associate's degree from a vocational education program, in the same study, earned on average 30% more than similar men with only a high school diploma (Silverberg et al., 2004).

Women who earned an associate's degree regularly saw substantially higher percent gains in their income, however, their median income was significantly lower than that of their male counterparts (Bailey et al., 2004; Compton et al., 2010; Maguire et al., 2012; Marcotte, 2010). Since most of the existing research examines gross income, the higher gains seen in women's salaries may be attributable to more women working part-time either before or during their educational studies (Marcotte, 2010). Alternatively, this may reflect the higher returns associated with credentials in the health sciences, a field that is predominately female (Bosworth, 2010; National Center for Education Statistics, 2012). The lower median wages for women reflect the disparities seen nationally in earning between the genders. Women with associate's degrees make on average $7,280 less than men with associate's degrees (Baum et al., 2013). In the aggregate this disparity could be a factor of the variation in the value of an associate's degree by industry or program of study. Specifically, women graduates in business; informational technology; marketing; and manufacturing, science, technology, engineering, and math fields, had lower medium incomes as compared to their male counterparts (Compton et al., 2010; Maguire et al., 2012). Finally, men were more likely to benefit from having completed

some college courses, but not having a credential than were women (Bailey et al., 2004; Maguire et al., 2012).

Nontraditional-aged students. Students who initiate their career and technical education coursework when they are 25 years old or older have different educational persistence and employment patterns than those of younger students. Older students are more likely to leave prior to earning a credential (Maguire et al., 2012). This finding may be a reflection that younger and older students may have different goals for enrolling in career and technical education. Silverberg et al. (2004) found that of students over the age of 24 in vocational programs, 48% reported that their primary goal was to enhance their job skills, and 30% reported their primary goal was personal enrichment. Comparatively, 30% of younger students reported job skills as their primary goal, and 12% reported their primary goal to be personal enrichment. The younger population of students was more likely to report transfer as a primary goal (36% compared to 15% for older students).

The net benefit in earnings for nontraditional aged graduates from vocational programs is lower than it is for younger students (Jacobson et al., 2004). However, nontraditional aged graduates of vocational programs in community colleges, who earned an associate's degree, had on average higher medium incomes during their last year in the program and for the three years after graduation (Sanchez & Lannan, 1997). This suggests that while the percent gain is less for older graduates from vocational programs, their median annual earnings are higher than those of traditional-aged students. These findings may be reflective of the fact that some older students can leverage previous education and work experiences in addition to their newly earned credential to better position themselves in the labor market (Sanchez & Lannan, 1997).

Racial and ethnic minoritized students. While the proportion of racial and ethnic minority college students doubled between 1976 and 1996 from 15.7% to 30.3%, Black students and Latino students are significantly underrepresented in the college population (Maxwell & Shammas, 2007). One of the major contributors to this underrepresentation in college attendance is the low percentage of these students graduating from high school ready for college citing that 20% of Black students and 16% of Latino students leave high school ready for college (Green & Foster, 2003). Black students and Latino students are underrepresented in the body of college ready students (Green & Foster, 2003). Green and Foster (2003) found that, 14% of the total population of 18 year olds were Black, they were 9% of the body of students who were graduating from high school and ready for college. Likewise, they found while that 17% of the total population of 18 year olds were Latino, they too were 9% of the body of students who were graduating from high school and ready for college (Green & Foster, 2003). Attewell et al. (2006) found that, "well over half of minority students who ultimately graduated [from college] initially failed academic skills tests" (p. 890). Unfortunately, the stigma and fears associated with participating in developmental education are higher among minority populations, and as such these populations are less likely to engage in this form of educational support (Deil-Amen, 2011).

This disparity is not limited to Black and Latino students graduating from the secondary system. Black and Latino adults are three- to four-times more likely to have low literacy skills in comparison with White adults (Maxwell & Shammas, 2007; Organisation for Economic Co-operation and Development, 2013). The disparity for the Latino population is troubling, with 48% of the adult population lacking a high school credential and college attainment rates that are substantially lower than those of other racial and ethnic groups (Ruppert, 2003). Individuals who

migrated to the United States make up one third of the country's low-skilled population (Organisation for Economic Co-operation and Development, 2013). It is important to note, that there is reluctance among some racial subgroups to participate in vocational and career training education. This reluctance and the stigma associated with career and vocational training is in part, rooted in the historic tracking of low-income and minoritized populations into vocational education and early roots of vocational training was forced on destitute individuals (Gray & Herr, 1998).

Students in racial minority groups who earned associate's degrees in vocational education and career training programs saw comparable or higher labor market gains compared to graduates who were White (Compton et al., 2010; Goldstein et al., 2012; Grubb 2002). However, graduates with associate's degrees, from racial minorities, had a lower median income than that of their White counterparts (Bailey et al., 2004; Maguire et al., 2012). Despite growth in the proportion of racial and ethnic minority groups enrolled in postsecondary study, especially Latino students and Black students continue to be underrepresented relative to credentials earned (Graham, 2013; Congleton, 2012). Looking broadly, racial and ethnic minority graduates' labor market outcomes are not as positive as those experienced by their White counterparts (Bailey et al., 2004). However, this appears to vary across programs of study. For example, Compton et al. did not find a significant relationship in labor market outcomes among disaggregated racial groups in their study looking at business, information technology, and marketing graduates. Additionally, there is evidence that labor market outcomes for some subgroups are notably localized, and that this may be more marked for racial minorities and women, especially in inner city markets (Goldstein et al., 2012; Grubb, 2002; Van Noy & Weiss, 2010, 2012).

Low-income students. Students' socioeconomic status impacts both their ability to engage in educational opportunities and their likelihood of completion. Students from the lowest quartile of income make up 27% of vocational education and career training students in associate's degree programs (National Center for Education Statistics, 2012). As the costs of participating in education increase the number low-income students enrolled in higher education decreases (Ruppert, 2003). The higher costs of tuition, fees, supplies, and debt associated with health professions education poses a notable barrier for low-income students (Smedley et al., 2004). It is clear that these students are locked out of the system by financial barriers. Both Dowd (2003) and Choy (2000) found that students' combined earning and loans do not cover the net price of attending college. This trend in decreased participation of students from low-income families has led to an increased inequity in participation between low-income students, and their middle-to-high-income peers (Ruppert, 2003).

Low-income students tend to be less prepared for college, and are more likely to work full time while attending school part time, and have a reduced likelihood that they will complete their program (Dowd, 2003; Ruppert, 2003). Low-income students are also more likely to be first-generation students who, as a subgroup, are more likely to participate in technical and pre-professional coursework (Pascarella, Wolniak, Pierson, & Terenzini, 2003). Additionally, first-generation students tend to have lower grades, complete fewer credit hours, and take fewer math and science courses (Pascarella et al., 2003).

Students' receipt of Pell grants or eligibility for Pell grants are common indicators used to note students' social economic class, although some research focusing on older students has utilized income history such as that obtained from unemployment insurance. Students who receive Pell grants, and who complete an associate's degree often see the largest percentage of

labor market gains. In California this population of students saw a 125% gain after receiving a certificate and a 195% gain after receiving an associate's degree (Sanchez & Laanan, 1997). Looking across the student body, students who earn a certificate see a 34% gain in income, and students who earn an associate's degree see a 71% gain in income (Sanchez & Laanan, 1997). Despite these significant gains, social economic class and employment status were both found to have a negative correlation with the labor market outcomes of students in career and technical training (Compton et al., 2010) and vocational education (Goldstein et al., 2012; Jacobson et al., 2004; Maguire et al., 2012). In other words, despite seeing far larger gains in income over their peers, students with a low socioeconomic status in these studies collectively earned less than students with higher socioeconomic status who have earned the same-length credential certificate or associate's degree.

Underserved populations and educational equity. Educators who are working for educational equity envision an educational system where students' educational outcomes are not predictable based on factors that do not represent the students' experiences, skills, ability, knowledge or character such as their race, gender, or socioeconomic status (Levin, 1994). As such, it is important in considering educational equity to distinguish between factors that could reflect students' knowledge, skills, and abilities (KSAs) and factors that do not represent students' KSAs. In this study there are six subgroups of underserved students: a) Latino students, b) Black students, c) students who were eligible for Pell grants d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education. Each of these populations are underserved in health professions education. However, the characteristics that define these subgroups have different properties in relation to educational equity.

Two of the subgroups are based on characteristics that may, in part, reflect the students' KSAs, and the other four subgroups are based on demographics that do not reflect the students' KSAs.

The two subgroups based on factors that may reflect students' KSAs are nontraditional-aged students and students who completed developmental education. Nontraditional-aged students as a group may be able to draw on KSAs developed through a more extensive history of educational and work experiences than that of traditional-aged peers. In fact, in Mincer's (1958) seminal study of the impacts of human capital investments on individual's income, Mincer used age as a proxy for the level of experience for each of the subjects in his study. The purpose of developmental education is to provide students the opportunity develop their KSAs in order to be fully prepared to take college level courses. Most students who participate in developmental education have taken assessments related to math, reading, and/or writing skills. The results of these assessments are used by colleges in determining who they will recommend complete developmental education courses either before or concurrently with their college level courses. As such, it would be anticipated that there would be differences in the educational outcomes of students of different age groups, and between students who do and do not participate in developmental education.

Disparities in educational outcomes for these subgroups of students could reflect differing KSAs and differing intents. Disparities in educational outcomes for these subgroups of students may also reflect systemic failure to meet the needs of these subgroups, as well as the intersection of these characteristics with other student demographics. As such, without the necessary data to tease out the effects of differing KSAs and other causes for the disparities in educational outcomes for these subgroups, attributing the extent of educational inequities is

challenging. However, in any case, efforts to reduce the disparities in educational outcomes contribute to lowering educational inequities and promoting success for these groups of students.

The remaining four subgroups are based on students' demographics, including race, ethnicity, gender, and socioeconomic status. Unlike age, these demographic characteristics reflect those highlighted by Levin (1994) in his criteria for educational equity. Specifically, the four remaining subgroups are a) Black students, b) Latino students, c) male students, and d) students who were eligible for Pell grants. These are factors that do not reflect the KSAs of the students, and as such, students in these subgroups should have similar educational outcomes as their peers with different demographics. However, because of the disparate effects of discrimination that occur both within and external to educational settings, the outcomes for these underserved student subgroups have historically been disparate in comparison to their peers (Bensimon & Harris, 2012; Dowd & Bensimon, 2015). This discrimination includes both intentional and unintentional actions of individual, as well as systematic discrimination that is embedded within systems and organizational cultures (Becker, 1971; Dowd & Bensimon, 2015). Scholars who are working to build educational equity strive to recognize, acknowledge, and actively respond to disparate effects of discrimination that occur both within and external to the educational system (Bensimon & Harris, 2012; Dowd & Bensimon, 2015).

The findings discussed to this point related to underserved populations at community colleges and in postsecondary vocational education and career training. In the next section, the literature on inequitable representation specific to health professions is summarized. These findings reflect the need to increase the diversity of the body of available health professionals that has fueled a call to action and efforts to improve the educational equity of health professions programs of study (Blagg & Blagg, 2008).

Inequitable Representation in Health Professions

There is a long history of racial and ethnic underrepresentation and discrimination in the health professions **(**Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004; The Sullivan Commission, 2004). There has been a rising concern among scholars and policy makers about the need to train a more diverse population of health professionals. The result is the call issued by the courts, researchers, and policy makers at the federal level for strategic action at all levels with the intent of improving the representations of underserved populations in health professions occupations (Baldwin, et al., 2006; Blagg & Blagg, 2008; Brown, DeCorse-Johnson, Irving-Ray, & Wu, 2005; Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004; Smedley et al., 2004). Efforts to increase the representation of underserved populations in health professions programs of study have had limited success (Carnevale et al., 2012; Smedley et al., 2004).

The call for increased equity in health occupations is being fueled in part by an increasing awareness of the connection between the healthcare provided to underserved populations and the representation of these populations among the health practitioners. Likewise, there a growing awareness of the relationship between patient outcomes and the diversity of healthcare institutions (Chevannes, 2002; Crowley, 2010; Smedley et al., 2003; U.S. Commission on Civil Rights, 2010; Williams et al., 2014). Populations that are underserved by the healthcare system are more likely to seek out and receive care from providers from the same racial and ethnical background as themselves (Balogun, Sloan, & Hardney, 2005; Brown et al., 2005; Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare

Workforce, 2004). Likewise, health professionals from underserved populations are more likely to provide medical care to medically underserved populations (Smedley et al., 2004). As a result, improving diversity among health practitioners is one means of improving healthcare provision for underrepresented populations. Additionally, health professions educators and employers are increasingly recognizing that diverse student and employee populations promotes culturally competent provision of health services (Committee on Institutional and Policy-Level Strategies for Increasing the Diversity of the U.S. Healthcare Workforce, 2004). Moreover, students in healthcare programs of study respond favorably to being part of a diverse student population, citing the opportunity to learn from diverse viewpoints (Whitla, Orfield, Silen, Teperow, Howard, & Reede, 2003).

Allied health occupations make up nearly 60% of the health profession workforce (Association of Schools of Allied Health Professions, 2014). Allied health programs of study are commonly taught as part of community colleges' postsecondary vocational education and career training programs of study. Among most allied health professions Black and Latino populations combined account for less than 15% of these occupations (Baldwin et al., 2006; National Center for Health Workforce Analysis, 2015). Recent labor market data reveal that these rates are not consistent across allied health occupations. There are two notable outliers in representation of the Black and Latino populations in health sciences. These outliers are both in entry-level occupations that are associated with very short-term credentials.

Black individuals are notably overrepresented in the nursing aide and home health aide occupations. During the 2010-2012 time period, 13.6% of the working age population was Black (National Center for Health Workforce Analysis, 2015). However, 37.5% of the nursing aide and home health aide population were Black (National Center for Health Workforce Analysis, 2015).

Similarly, during the 2010-2012 time period 15.5% of the working age population was Latino (National Center for Health Workforce Analysis, 2015). And, 22.5% of dental assistants were Latino. Both of these occupations are entry-level occupations in their respective health pathway, with relatively low skill requirements and low rates of compensation. These positions may or may not require college coursework based on the employer-defined requirements for the job and state regulations. However, in both cases college-level coursework is increasingly required for these jobs.

Certified nursing aide or home health aide programs are often three-to-six credits in length, in programs designed to be completed in a single semester, while certified dental assistant programs are typically around 30 credits and are in programs designed to take two-to-three semesters. Both of these programs, are offered at some institutions as noncredit programs of study and at others as credit-bearing programs. At some institutions, students have noncredit, incumbent, and credit-bearing options to choose from. It is unclear what contribution to this overrepresentation of these two occupations is related to individuals who are in these entry-level positions who were trained on-the-job or through a program of study. Either way these outliers demonstrate engagement by these populations in allied health occupations that is notably absent from the remaining allied health occupations (Baldwin et al., 2006; National Center for Health Workforce Analysis, 2015).

Health Professions Pathways (H2P) Consortium

The United States Department of Labor in partnership with the United States Department of Education awarded $1.945 million in TAACCCT program grants over four annual rounds (Martin, 2015). Over the four year period, 256 awards were made that involved nearly 700

colleges. The first round of TAACCCT grants totaling nearly $500 million were awarded on September 26, 2011 (U.S. Department of Labor, n.d.-a). The $500 million was distributed across 49 awards that ranged from $2.5 million dollars for state designated grants to $20 million dollars for consortia of colleges (U.S. Department of Labor, n.d.-a). These 49 awards included: 5 multi-state consortia, 18 single state consortia, and 17 state designated grants. Single state consortia awards involved a total of 142 community colleges and 2 universities received funding (U.S. Department of Labor, n.d.-a). Multi-state consortia awards comprised of a total of 40 colleges, located in 18 states and the District of Columbia, received a total of $91 million in grant funding (U.S. Department of Labor, n.d.-b). State designated awards, between $2 - 3 million each, were given to states that were not part of a selected consortia proposal (U.S. Department of Labor, n.d.-a).

The Department of Labor had four priorities for Round One of TAACCCT funding (U.S. Department of Labor, 2011). The first priority was to accelerate progress for low skilled and other workers. Under this priority grantees were encouraged to build programming that efficiently and effectively helped students to gain the foundational skills necessary to enter, be retained in, and complete a program of study. Also under this priority, grantees were encouraged to improve support services to increase retention and completion of programs of study by grant participants. The second priority was to improve retention and achievement rates and to reduce time to completion. Under this priority grantees were encouraged to make systematic and programmatic improvements that would "reduce barriers to enrollment, increase success rates, and reduce the time it takes to obtain degrees, certificates, and other industry-recognized credentials" (U.S. Department of Labor, 2011, p. 6). The third priority was to build programs that meet industry needs, including developing career pathways. Under this priority grantees

were encouraged to ensure that programs were relevant to workforce needs and that integrate the competencies needed by industry. Further, grantees were to ensure that the programs resulted in a credential that were industry-recognized and that were "portable, stackable, and support placement into employment in a career pathway and/or further education" (U.S. Department of Labor, 2011, p. 7). The final priority was to strengthen online and technology-enabled learning. Under this priority grantees were encouraged to use technology to engage students in innovative ways to engage students and accelerate their learning. Included were online learning as well as simulations, personalized instruction, game design, and other technology enhanced pedagogy.

One of the largest multi-state round one TAACCCT grant was awarded to H2P. H2P was a consortium of nine community colleges across seven states that focused on educating health professionals. H2P was awarded a TAACCCT grant of $19.6 million for the period of October 1, 2011 through September 30, 2015. H2P used TAACCCT funding in an effort to effect transformative change in health professions education through the development and enhancement of health professions programs of study and through a set of eight strategies intended to improve student educational and employment outcomes. Not all of the H2P health professions programs of study were impacted by TAACCCT funding. H2P focused their TAACCCT work in occupational areas they identified as garnering high wages in area were the labor market demand exceeded the supply of available health professionals (Cincinnati State Technical and Community College, 2011).

H2P was a national consortium of nine colleges, in seven states, that focused on the development and enhancement of programs within the healthcare industry and use of eight strategies to effect transformative change. Cincinnati State Technical and Community College was the lead college. The co-grantee college were:

- Anoka-Ramsey Community College (ARCC), Coon Rapids, MN,
- Ashland Community and Technical College (ACTC), Ashland, KY,
- Cincinnati State Technical and Community College (CSTCC), Cincinnati, OH,
- El Centro College (ECC), Dallas, TX,
- Jefferson Community and Technical College (JCTC), Louisville, KY,
- Malcolm X College (MXC), City Colleges of Chicago, Chicago, IL,
- Owens Community College (OCC), Perrysburg, OH,
- Pine Technical and Community College (PTCC), Pine City, MN,
- Texarkana College (TXC), Texarkana, TX.

H2P used TAACCCT funding to enhance and develop a total of 41 health professions programs of study. The six largest TAACCCT-funded programs of study by enrollment were: a) Certified Nursing Assistant, b) Practical Nursing, c) Registered Nursing, d) Medical Assisting, e) Pharmacy Technician, and f) Emergency Medical Technician (Bragg et al., 2015). Over the four years of the grant, H2P engaged more than 6,500 participants through strategies, 4,888 of whom enrolled in TAACCCT-funded health professions programs of study (Bragg et al., 2015).

H2P strategies. As part of their scope of work, H2P colleges implemented eight strategies. The first strategy, was to galvanize a national movement to reform health professions education. This strategy was the consortium's commitment to "engaging community college, employer, and workforce partners in an effort to effect transformative change" (Office of Community College Research and Leadership, 2015). The second strategy was a commitment to "enhance data and accountability systems" (Office of Community College Research and Leadership, 2015). This strategy reflected both a commitment to meet the reporting requirements

associated with the grant, and a commitment to improve the colleges' capacity to collect and use data to support ongoing change (Office of Community College Research and Leadership, 2015).

The remaining six strategies were intended to build the colleges capacity to provide quality health professions pathways, and improve retention and completion of the students in these pathways. These six strategies are summarized based on the findings described in *Third Party Evaluation of the Impact of the Health Professions Pathways (H2P) Consortium* (Bragg et al., 2015). The implementation of these strategies at each H2P colleges is described in depth in the implementation evaluation report, *Third Party Evaluation of Implementation of the Health Professions Pathways (H2P) Consortium: Nine Co-Grantee College Site Reports* (Office of Community College Research and Leadership, 2015). Cross-college summarizes of the implementation of each strategy is summarized in the impact evaluation report, *Third Party Evaluation of the Impact of the Health Professions Pathways (H2P) Consortium* (Bragg et al., 2015).

Online assessment and enhanced career guidance. The central activity associated with this strategy was the implementation of prior learning assessments (PLA) at H2P colleges. The Council for Adult and Experiential Learning provided the following definition for PLA:

> PLA is the process by which many colleges evaluate for academic credit the college-level knowledge and skills an individual has gained outside of the classroom (or from non-college instructional programs), including employment, military training/service, travel, hobbies, civic activities and volunteer service. (CAEL, 2010, p. 6)

H2P utilized PLA to recognize the skills and knowledge gained by students through their experiences prior to entering their program of study. This strategy was intended to accelerate students' time to completion and increase graduation rates (CAEL, 2010; Hayward & Williams,

2015). This strategy targeted Trade Adjustment Act (TAA) eligible individuals, displaced workers, and incumbent workers who had transferable knowledge, skills, and abilities from previous work and life experiences (Cincinnati State Technical and Community College, 2011). PLA processes were implemented or enhanced at all nine colleges, however, none of the H2P participants at ACTC earned PLA during the period from January, 2012 – December, 2014. Across the remaining eight colleges, during this 3-year period, 415 students earned credit for prior learning through the new or enhanced PLA processes with a total of 3,055.5 credits that were granted or waived. In comparing the demographics of the students who did and did not received credit for prior learning through the PLA processes, Bragg et al. (2015) found a higher percentage of CPL students were female, White, and nontraditional age.

Contextualized developmental education. H2P colleges developed and implemented contextualized developmental education courses designed to improve students' foundational skills in reading, writing, and math. Mazzeo, Rab, and Alssid (2003) provide the following definition of contextualized developmental education:

> A diverse family of instructional strategies designed to more seamlessly link the learning of foundational skills and academic or occupational content by focusing teaching and learning squarely on concrete applications in a specific context that is of interest to the student. (Mazzeo et al., 2003, pp. 3 – 4)

Contextualized learning positively impacts students' basic skills, progression in coursework, completion of developmental education, entry into credit-bearing classes, and performance in college level courses (Perin, 2011). H2P utilized contextualized developmental education to introduce students to health terminology and concepts, and improve the likelihood that students

who completed developmental education coursework would subsequently earn a health professions credential (Cincinnati State Technical and Community College, 2011).

H2P colleges utilized two approaches to this strategy. The first approach was to integrate health information into developmental education courses reading, writing, and math. Across the consortium, seven colleges integrated health professions information into one or more development education courses. However, the bulk of these courses were discontinued, with many only being offered once or twice and with limited enrollment. At the end of the grant a total of three colleges were planning to sustain developmental education courses with integrated health professions content. The second approach was to integrate basic skills instruction in entry level health professions coursework, most commonly within the healthcare occupations core curriculum courses. Across the consortium, there were seven colleges that integrated developmental education instruction into health professions coursework. One college reported discontinuing its use of integrated basic skills instruction. At the end of the grant, six H2P colleges planned to sustain a total of 21 healthcare courses with integrated basic skills instruction.

Healthcare occupations core curriculum. H2P colleges developed and implemented a healthcare occupations core curriculum (HOCC) that raises students' awareness of career options, prepares students for rigor of healthcare study, provides students with foundational knowledge and skills, and expands access for underserved populations (Cincinnati State Technical and Community College, 2011). McPherson (2004) defines a HOCC as follows:

> A set of interdisciplinary courses, clinical training, and other educational exposures designed to provide allied health students at each level with the

> common knowledge, skills, and values necessary to perform effectively in the evolving health care workplace. (McPherson, 2004, p. 30)

The HOCC as envisioned by H2P as an integrated and cross-professional coursework that builds a set of shared competencies that span the health professions. The HOCC courses are available outside of a program of study, and students are not required to be assessed for college level skills in reading, writing, and math to enroll in most HOCC courses. Instead colleges integrated developmental education opportunities into the HOCC courses, building students foundational skills and improving their ability to successful assess and enroll in a health professions programs of study. The intent is for this strategy to attract and retain a more diverse student population and to improve graduates employment rates (McPherson, 2004). This strategy is endorsed by industry members who that see having a more diverse workforce who is cross-disciplinarily trained and proficient in basic skills as key benefits of the HOCC (Wolfson & Lavelle, 1991).

ECC had over 10 years of experience in the development and implementation of a HOCC. The consortium capitalized on ECC's expertise, with ECC mentoring and facilitating the implementation process across the nine colleges. Across the consortium, 20 new courses were developed and 20 existing courses were enhanced as each college developed its own customized core curriculum. The HOCC course offering developed and implemented varied among the H2P colleges. At ACTC, JCTC, ECC, TC, and OCC provided a larger selection of HOCC courses of five to eight courses. At ARCC, CSTCC, MXC, and PTCC the HOCC ranges from one to three courses. Despite the difference in course selection, on average students who enrolled in one or two HOCC courses. Over the course of the first three years, 2,202 unique H2P students enrolled in 3,682 HOCC courses, with a completion rate of 97.5%. Of the H2P participants, 33.5% enrolled in one or more HOCC courses. However, the percentage of H2P participants at each

college who enrolled in HOCC varied greatly from 2.0% at ACTC to 77.9% at ECC. Bragg et al. (2015) compared the students who did and did not enroll in HOCC and found that a higher percentage of Latino students and a smaller percentage of Black and White students enrolled in HOCC courses.

Incumbent healthcare programs. H2P colleges developed new and enhanced existing incumbent healthcare programs. Incumbent healthcare programs are provided through a partnership between healthcare institutions, community-based organizations, workforce partners, and educational partners (Biswas, 2011; Department of Labor, 2010, Moss & Winstein, 2009). These programs provide training for currently-employed workers with the intent of either retaining their employment or preparing them for new positions within the health filed.
The intent of this strategy was to provide lower-skilled healthcare workers a pathway to advance their career. Both employers and employees have been shown to benefit from the implementation of incumbent worker programs. Benefits to employees include promotions, avoiding layoffs, and increases in benefits and wages (Department of Labor, 2010; Hollenbeck, 2008). Benefit to employers' include improved retention of staff, access to higher skilled employees, improved patient outcomes, and fewer unfilled vacancies (Proscio, 2010). Targeted incumbent training programs have been shown to increase diversity of healthcare professionals, while addressing labor shortages and promoting local economic development (Biswas, 2011; Moss & Winstein, 2009). Under this strategy the H2P Consortium specifically sought to build incumbent healthcare programs that targeted lower-skilled healthcare workers for more advanced positions (Cincinnati State Technical and Community College, 2011). H2P cited three additional goals in their adoption of this strategy to: a) address critical staff shortages, b) increase job satisfaction and

retention rates, and c) improve quality of care (Cincinnati State Technical and Community College, 2011).

New or enhanced incumbent healthcare worker training programs were implemented at ARCC, ACTC, ECC, JCTC, and PTCC between January 2012 and December of 2014. Programs that were developed with and for the employer partners are substantially different among the colleges. Incumbent worker programs varied across the colleges both by length of program and the number of employer partners the program supported. Programs ranged from short-term certificate programs such as ARCC's CNA and Trained Medical Aid programs, to associate level programs such as ECC's Associate's Degree programs in Nursing. Most of the incumbent programs were developed in partnership with single employers such as ACTC's STNA program taught at King's Daughters Medical Center, whereas a few of the programs were developed in collaboration with multiple employers, such as PTCC's Phlebotomy program. Likewise, the roles that employers took in the development and implementation of incumbent training programs varied across the programs and colleges. Some employers helping to identify the need for programs, others referring employees to participate and still others taking active roles in curriculum development and clinical instruction.

Enhanced retention services. H2P colleges provided students with comprehensive and inclusive retention services intended to foster students' retention and completion within health occupations programs of study. Research suggests that individualized student advising and other student supports improve academic outcomes for students and support students transition and progression in their careers. Short-term academic outcomes that have been linked to retention supports include: students register for more classes, and higher rates of course completion and earning more credits (Bettinger & Baker, 2013; Scrivener & Weiss, 2009). Additionally, students

who receive retention support services are more likely to apply for and be awarded financial assistance (Scrivener & Weiss, 2009). Students who receive retention services are more likely to be retained in their program of study and graduate (Bettinger & Baker, 2013; Scrivener & Weiss, 2009). Studies have also shown that student support services and career development improve access to career pathways for underserved populations, and improve students' transition from education to the workforce (Summer, 2003; Tatham, 2009).

H2P used four approaches to enhance their capacity to provide retention supports to better support a diverse body of students in achieving their educational and career goals (Cincinnati State Technical and Community College, 2011). The first approach was to build collaborative partnerships with community-based organizations and workforce partners in order to recruit potential students and supplement the resources of the colleges to expand retention services. The second approach was to provide more comprehensive career planning services. This included integrating career information into the HOCC course and provided students with technology assisted career planning resources. The third approach to this strategy was individualized intensive relationship based comprehensive supports. These supports including identifying with and demonstrating concern for students who may be at risk of withdrawing from the program goals (Cincinnati State Technical and Community College, 2011). The final approach was technology assisted employment, including implementing new systems to help provide students with information about current employment opportunities. This included testing a text messaging system that would provide employment information to both current students and program graduates. This last approach was discontinued due to complications with the selected vendor, implementation, and feedback from students.

Industry-recognized stackable credentials. H2P colleges built industry-recognized stackable credentials programs that accelerated time to completion, streamline pathways to the labor market, and advance lower-skilled healthcare workers into more advanced positions. The Employment and Training Administration provides the following definitions for industry-recognized and stackable credentials:

> An industry-recognized credential is one that either is developed and offered by or endorsed by a nationally-recognized industry association or organization representing a sizeable portion of the industry sector, or a credential that is sought or accepted by companies within the industry sector for purposes of hiring or recruitment which may include credentials from vendors of certain products. (Oates, 2010, p. 6)

> A credential is considered stackable when it is part of a sequence of credentials that can be accumulated over time to build up an individual's qualifications and help them to move along a career pathway or up a career ladder to different and potentially higher-paying jobs. For example, one can stack a high school diploma, an associate's degree, and then typically obtain two more years of appropriate postsecondary education to obtain a bachelor's degree. An individual can also stack an interim career/work readiness or pre-apprenticeship certificate, then complete an apprenticeship, and later earn a degree or advanced certification. (Oates, 2010, p. 6 - 7)

Industry-recognized stackable credentials are a central component of career pathways (Kozumplik, Nyborg, Garcia, Cantu, & Larson, 2011). There are a number of known benefits to industry-recognized stackable credentials. These benefits include higher rates of completion and labor market gains for students, and access to increasingly skilled and experienced employees for

employers (Austin, Mellow, Rosin, & Seltzer, 2012; Oates, 2010). Between January 2012 and December of 2014, ARCC, ACTC, JCTC, MXC, and PTCC implemented new industry-recognized stackable credentials. In total the colleges implemented a total of 13 new programs of study including four associate's degree programs. These 13 programs are part of 11 sets of stackable credentials, eight that include a combination of certificate programs and associate degree programs and three that include multiple levels of certificate programs of study. These credentials included credentials in pharmacy technician, emergency medical services, health science technology, nursing, and medical assisting. As of December 2014, CSTCC, ECC, OCC, and TC had not implemented new TAACCCT-funded industry-recognized stackable programs of study.

Summary

A central premise of HCT is that an investment in human capital through education has economic benefits for both the individual and society as a whole (Becker, 1994; Mincer, 1958; Sweetland, 1996). Alternatively, signaling theory and critical theories both call into question the root of economic benefits that are associated with educational achievement. Under signaling theory a credential could be a representation of the human capital that is shared via an information exchange that is part of the employment process (Dobb et al., 2008; Sweetland, 1996). However, the signal of a credential also includes factors, such as the reputation of the institution that may or may not accurately reflect the human capital of the applicant. Critical theorists argue that the benefits of education are reflective of the transfer of cultural capital that is associated with social class and the transference of class-based cultural norms that reinforced structural inequities (Meyer, 1977). Taken as a whole, these theories suggest that there are economic benefits associated with education; however, due to structural

and societal norms that privilege some populations over others, the economic benefits associated with investments in human capital may not be equitable among populations that offer comparable human capital.

The relationship between education and employment outcomes central to HCT is supported by the empirical evidence, as are concerns about inequitable outcomes among underserved populations. Specifically, there is substantial evidence to support the assertion that there are economic benefits for individuals who earn long-term certificates and associate's degrees (Belfield & Bailey, 2011; Bosworth, 2010; Jepsen et al., 2014; Marcotte et al., 2005). Further, researchers found that retention and labor market returns associated with completing a postsecondary vocational education and career training programs are comparable to or better than those associated with completing academic programs (Bailey et al., 2004; National Center for Education Statistics, 2012). However, negligible economic benefits have been associated with short-term certificates (Dadgar & Weiss, 2012; Jepsen et al., 2014). For this reason, and because there is a disproportionate representation of underserved populations enrolled in certificate programs as compared to associate level programs, it is important to account for the length of a program when examining program of study enrollment, completion, and employment outcomes (National Center for Education Statistics, 2012). Researchers have demonstrated that when looking at education broadly, completion and the associated economic gains are not equitable for low-income students, Black students, and Latino students (Bailey et al., 2004; Compton et al., 2010; Green & Foster, 2003; Maguire, 2012; National Center for Education Statistics, 2012).

Postsecondary vocational education and career training is a central piece of the comprehensive mission of community colleges, with community colleges enrolling about six

million postsecondary vocational education and career training students annually (National Center for Education Statistics, 2012). Additionally, community colleges serve a high percentage of the underserved populations in higher education, positioning community colleges as important players in efforts to support equitable access and educational outcomes (American Association of Community Colleges, 2015a; National Center for Education Statistics, 2013). Highlighting the variation in educational and employment outcomes by industry across postsecondary vocational education and career training, especially for underserved populations, researchers have illustrated the value of focused studies that examine students' outcomes within industries or career clusters (Compton et al., 2010; Dadgar & Weiss, 2012).

Healthcare is the largest career cluster in postsecondary vocational education and career training in terms of credentials awarded, accounting for 43% of all vocational credentials awarded for a total of 606,899 credentials in 2010 - 2011 (National Center for Education Statistics, 2012). In part because of a growing awareness that there are beneficial relationships between utilization of healthcare, patient outcomes, and the increased diversity of health professionals at healthcare institutions and because of the rise in demand for health professionals, efforts are being made to diversify the population of student participating in health professions education (Blagg & Blagg, 2008; Crowley, 2010; Smedley et al., 2004; U.S. Commission on Civil Rights, 2010; Williams et al., 2014). However, despite efforts to improve diversity in health professions education the underrepresentation of both Black and Latino health professionals persist (Association of Schools of Allied Health Professions, 2014; Baldwin et al., 2006; Bragg et al., 2015; Crowley, 2010; National Center for Health Workforce Analysis, 2015; Smedley et al., 2004). Further, among allied health professions Black and Latino employment is heavily concentrated in low paying entry-level occupations that typically require minimal or no

college-level training (Baldwin et al., 2006; National Center for Health Workforce Analysis, 2015).

The federal government made a nearly $2 billion human capital investment in the form of through TAACCCT. These grants were intended to expand community colleges capacity by investing in the development of programs of study in key industries and building innovative strategies to improve student retention and completion rates. The H2P was a national consortium of nine colleges, in seven states, that received a $19.6 million TAACCCT grant to develop and enhance of programs within the healthcare professions. With the support of TAACCCT funding, H2P employed a set of eight strategies to effect transformative change; including galvanizing a national movement to reform health professions education. H2P focused their TAACCCT work in occupational areas they identified as having a demand for skilled workers in high wage occupations that exceeded the supply of available health professionals (Cincinnati State Technical and Community College, 2011).

Methods

This study examined the enrollment and educational outcomes of underserved student subgroups in H2P colleges' health professions programs of study before and after receiving TAACCCT funding. Specifically, the study compared a comparison sample of students from eight of the nine H2P co-grantee colleges who enrolled coursework in health professions programs of study in 2008 or 2009, with a participant sample of students who enrolled in health professions programs of study at the same eight H2P colleges in 2012. Demographics of the H2P and comparison samples of students, as well as their retention and program completion over a three year period (2008 - 2010, 2009 - 2011, and 2012 - 2014) were compared. The underserved subgroups examined in this study were: a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. This study addresses the following research question:

> Were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges?
>
> a. What changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding?
> b. What changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding?

H2P Evaluation

The Office of Community College Research and Leadership conducted a third party evaluation of H2P that included three primary components: 1) implementation evaluation, 2) impact evaluation, and 3) performance reporting to the Department of Labor.

Two secondary data sets created as part of the third party evaluation conducted by: a) H2P participant and comparison student database, and b) TAACCCT-funded program of study dataset. The researcher is an employee of the Office of Community College Research and Leadership and was part of the team that conducted the third party evaluation of H2P. The third party evaluation of H2P focused on the implementation and impact related to the interrelated strategies enacted by the consortium in an effort build programs of study and career pathways in healthcare (Bragg et al., 2015; Office of Community College Research and Leadership, 2015). This dissertation involves secondary analyses separate from the evaluation studies conducted by the Office of Community College Research and Leadership (2015) and Bragg et al. (2015).

The third party evaluation was a mixed methods evaluation that included ongoing feedback and capacity building components. The data collected by OCCRL for the third party evaluation of H2P included: a) student record data on each student who enrolled in in the H2P TAACCCT-funded programs of study or received H2P TAACCCT-funded services; b) metrics reflecting activities and services associated with TAACCCT-funded strategies;

c) implementation data collected through series of individual and groups interviews of stakeholders during two sets of on-campus visits, d) observations from the consortium's meetings and conferences (both virtually and in person), e) observations of classrooms conducted during on-campus visits, f) data collected through document review and analysis,

g) student record data on a comparison sample of students selected by the colleges who were enrolled in health professions programs of study prior to receiving TAACCCT funding, and h) unemployment insurance wage data on H2P's TAACCCT participants and comparison sample of students. OCCRL collected student record data, metrics on activities and services, quarterly, and unemployment insurance wage data at least annually. In collaboration with the consortium and consortium colleges, OCCRL used this data to calculate and prepared the quarterly and annual performance reported required by the U.S. Department of Labor as a condition of TAACCCT funding. Among the data analysis methods used for the evaluation implementation narratives were member checking, thematic analysis, descriptive statistics, logistic regression, and propensity score matching.

Of the 4,888 participants who enrolled in programs of study 68% had either been awarded one or more credentials at the end of the grant or were still enrolled in the college (Bragg et al., 2015). A large percentage of H2P participants (43.3%), were still enrolled at the end of the grant period. Across the consortium 2,021 students earned a credential during the period of the grant. Credentials earned include 824 very short-term certificates, 144 short-term certificates, 501 long-term certificates, and 552 associate's degrees.

A lower percentage of H2P students in racial and ethnic minority subgroups were awarded credentials. OCCRL found that 38.6% of Black participants and 27.2% of Latino participants were awarded one or more credentials, as compared to 51% of White participants (Bragg et al., 2015). Educational outcomes for Black participants included a significantly lower likelihood of being awarded one or more credentials, long-term certificates, or associate's degrees; or of being retained at the end of the grant without a credential. White participants were 1.6 times more likely than Black participants to be awarded one or more associate's degrees.

Educational outcomes for Latinos included a significantly lower likelihood of being awarded one or more credentials, long-term certificates, or associate's degrees. The largest disparity was at the associate's degree level, with White participants being 2.4 times more likely than Latino participants to be awarded one or more associate's degrees.

OCCRL found that a higher percentage of H2P participants who were Pell-eligible were awarded credentials (42.5%) as compared to participants who were not eligible for Pell funding (39.6%) (Bragg et al., 2015). The most notable difference was that 13.0% of Pell-eligible participants earned long-term certificates as compared to just 8.7% of participants who were not Pell-eligible. Overall OCCRL found that a 62.3% of participants were not Pell-eligible and 70% of participants who were Pell-eligible were either awarded a credential or were still enrolled in at the end of the grant period—December 2014.

A higher percentage of females were awarded a credential (42.0%) as compared to men (38.5%) (Bragg et al., 2015). Men were awarded a higher percentage of very short-term certificates (18.9% versus 16.4%). However, a smaller percentage of male participants were awarded fewer short-term certificates (2.0% versus 3.1%), long-term certificates (9.3% versus 10.5%), and associate's degree (8.2% versus 12.0%).

The percentage of credentials earned was similar across age groups with 31.6% (19 and under participants) and 44.7% (22 – 24 year old participants) (Bragg et al., 2015). However, the percentage of different lengths of credentials varies more notably. While there was some variation across all program lengths and age groups, participants aged 19 and under were awarded the lowest percentage of credentials for all program lengths except for very short-term certificates (21.7%). For instance, 2.0% of participants aged 19 and under were awarded an associate's degree, compared to 14.2% of participants who were between 25 and 29. Every age

group was significantly more likely to be awarded an associate's degree when compared to participants were 19 years and younger.

Data Collection

This study utilized two sources of secondary data. The first source of secondary data was the data collected by the Office of Community College Research and Leadership as the third party evaluator for H2P (Bragg, et al., 2015; Office of Community College Leadership and Research, 2015). The primary dataset for this study was the OCCRL's student record data set that included both student data for H2P participants and a comparison sample of students who were enrolled at H2P colleges prior to the receipt of TAACCCT funding. Student record data of H2P was provided to OCCRL quarterly by each college. Student record data included students' demographics, course history, and credentials awarded. Identifying information was stripped from the student record data either by the college or researchers at OCCRL. Each student was assigned a proxy id that is used consistently through the dataset, allowing for analysis at the student without compromising students' confidentiality.

H2P colleges compiled the student record data provided to OCCRL from two distinct sources. The first data source was the colleges' databases that tracks students' transcript data. Data from the colleges' databases included information from the students' college application such as demographic data, and information reflecting the students' academic records at the college. The second source for student record data were intake forms completed by H2P participants. The intake form was developed to collect information, not available in the college database, from participants who received TAACCCT-funded services or enrolled in TAACCCT-funded programs of study. Data collected via the H2P participant intake forms are not available

for the comparison sample, therefore the data used in this study is limited to the data collected through the colleges' databases.

OCCRL also collected data about the colleges' health professions program of study that was used in this study. This data documents all health professions programs of study at H2P colleges, including those not impacted by TAACCCT funding. This data included the minimum credits required to complete each program, the courses associated with the program, and the type of credential associated with the program. The data set also indicates if the program is offered for-credit or not-for-credit, if the program was new or enhanced by H2P. Program of study data was provided by H2P colleges three times over the course of the four year period (2011-2014) that the consortium was funded by TAACCCT. Additionally, OCCRL collected publically available data on the programs of study offered at each H2P college from published program descriptions and course listing on the colleges' websites.

The second data source for this study is the National Center for Educational Statistics Integrated Postsecondary Education Data System's (IPEDS) *IPEDS 12-Month Enrollment* reports for each of the H2P colleges. This data was used in analyzing enrollment at H2P colleges using Bensimon et al.'s (2003) Equity Index and chi-square analyses, for the following subgroups: a) Latino students, b) Black students, and c) male students. Annual data on the number of students enrolled in developmental education coursework, eligible for Pell grants, and age at enrollment were not available through IPEDS and therefore this analysis is not extended to these subgroups. Specifically, the enrollment data for each college that was used for these analyses were the colleges' annual enrollment for each subgroup as reported in their annual *IPEDS 12-Month Enrollment*, available through the IPEDS data center (https://nces.ed.gov/ipeds/datacenter). For example, the proportion of Latino students enrolled in

each H2P college, was compared to the proportion of Latino students enrolled at each college in both samples. This data was used to examine enrollment at the college and consortium level. The samples for this study were selected based on calendar year, wherein the IPEDS data in the 12-Month Enrollment reports are reported annually from July 1 through June 30. The comparison sample was compared to the population enrolled at the college as reported in the colleges' 2009 IPEDS reports (July 1, 2008 - June 30, 2009). The H2P participant sample was compared to the population enrolled at the college as reported in the colleges' 2013 IPEDS reports (July 1, 2012 - June 30, 2013). This IPEDS data was used in the chi-square analyses. These analyses are used to compare the sample subgroups with the same subgroups at the college to examine if there were significant differences.

Population and Sample

The population of interest for this study were students enrolled in health professions programs of study in community colleges throughout the United States. This population was of interest because of the increasing call to build a more diverse and representative population of health professionals, and the critical role community colleges play in training this body of professionals. However, the sampling frame for this study deviates from the population of interest in multiple ways. The sampling frame and the samples selected from it are not random. Further, the sampling frame and resulting samples are not representative of the population of interest, therefore the findings of this study are unlikely to generalizable to the population of interest.

The sampling frame for this study were the students engaged in health professions programs of study at H2P colleges. More specifically, the sampling frame are the students

engaged in health professionals programs of study whose student record data was provided to OCCRL as part of the third party evaluation of H2P. The sampling frame for the study was the combination of two groups of students that OCCRL referred to as comparison students and H2P participant students. This group of 8,673 students were enrolled in health professions programs of study at H2P colleges between 2006 and 2011, prior to the colleges receiving TAACCCT funding. The group of H2P participants consisted of 4,693 students who were enrolled in TAACCCT-funded health professions programs of study between 2012 and 2014. The two samples for this study are drawn from these two participant groups, and were selected to provide the samples the maximum amount of time possible to reach the educational outcomes included in this study.

The sampling frame for this study was selected to highlight the potential impact of a federal investment in human capital, directed towards health professions programs of study at community colleges, on educational equity in these colleges. H2P provided an opportunity to see the changes in populations served in health professions programs of study, and to examine these students' outcomes, in colleges that have received a substantial federal human capital investment. This study both highlighted positive changes in educational equity for underserved populations, and illustrated persistent issues of educational equity.

The samples for this study were drawn from eight of the nine H2P colleges. The ninth college in the consortium, Malcolm X College, was excluded from this study because a comparison sample of students was not available. Two samples were selected from the sampling frame. The first sample was made up of 5,929 students from the comparison sampling frame, who enrolled in health professions programs of study in 2008 or 2009 at H2P colleges. In this study the sample is referred to as the comparative sample. It should be noted that in the OCCRL

study, the comparison sample frame was referred to as the retrospective sample, reflecting the fact that these students were engaged in health professions programs of study prior to the colleges receiving TAACCCT. The second sample was made up of 2,643 students who enrolled in health professions programs of study in 2012. This second sample is referred to as the participant sample, reflecting the fact that these students were engaged in TAACCCT-funded health professions programs of study.

Data Analysis

Bensimon et al.'s (2003) Equity Index, test of independence chi-square analyses, and logistic regression are the three data analysis methods that were used in this study. These methods were employed over three stages of analysis. The first stage in the analysis involved the use of the Equity Index and goodness-of-fit chi-square analyses to compare the composition of the studies two samples and demographic composition of the colleges for three subgroups: a) Latino students, b) Black students, and c) male students. These three subgroups were examined as compared to the college because of the availability of comparable IPEDS data. This analysis tested if the proportions of these subgroups in the comparison and participant samples were different from the college-wide student populations of the individual H2P colleges and collectively as a consortium. These analyses were done to place any changes examined between the comparison sample and H2P participant sample later in the analysis into context.

The second stage of the analysis involved using the Equity Index and chi-square analyses to compare the composition of the comparison and participants samples. The analysis looked at the difference in proportion of students who enroll, are retained, and earn credentials in each of the following subgroups examined in this stage were a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age

or older, and f) students who complete developmental education coursework. These analyses were done at the consortium level, by program of study length at the consortium level, and by college.

Logistic regression analyses were used in the third stage of the analysis to analyze the likelihood of students in each underserved subgroup being retained or completing their program of study. The subgroups examined in this stage were a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. The outcomes examined were: a) retained with no credential, b) awarded one or more certificates, c) awarded one or more credentials, and d) awarded one or more associate's degrees. A logistic regression analysis was run for each sample, for each outcome, and used to calculate the relative likelihood of each subgroup reaching the outcome. This analysis was done at the consortium level using a fixed effect technique to account for differences among colleges.

Equity Index. The Equity Scorecard was developed by University of Southern California's Center on Urban Education (Bensimon, 2004). The Equity Scorecard is an institutional change process that utilizes data to identify and address equity issues. The Equity Scorecard utilizes "four concurrent perspectives on institutional effectiveness in terms of equity in educational outcomes: access, retention, excellence and completion, and campus effort" (Harris et al., 2010, p. 298). The four perspectives are: access, retention, excellence and completion, and campus effort (Harris et al., 2010). Access includes measures that address students' access to institutions, programs, and resources including applications, admissions, enrollment, and developmental education courses. Retention includes measures that indicate students' academic progress including continuous enrollment, and accumulation of course

credits. Excellence and completion includes measures of excellence that focus on participation in selective programs and building academic and social networks; and measures of completion that assess the progression of students through milestones leading to credentials (associate's degree and certificate completion). Campus effort includes measures of institutional support and campus culture that support underrepresented and historically underserved students include use of support services, participation in key extracurricular programs, specialized support services, etc. (Harris et al., 2010).

As part of the Equity Scorecard process disaggregated data on key student success indicators under each perspective is examined both to identify gaps and to monitor efforts to correct these gaps. The Equity Index was developed as a statistical tool to convert percentages "into a standardized ratio that makes it possible to determine whether a particular group has attained equity on various indicators of educational outcomes" (Hao, 2006, p. 67). The Equity Index is used to calculate the measures related to each of the four perspectives in the Equity Scorecard (Bensimon et al., 2003).

The Equity Index is a standardized ratio that is used to describe differences in the proportion of a nested subgroup as it relates to a reference population. In this study the Equity Index was used both to understand the proportional difference of subgroups as it related between the samples and colleges, and proportional differences of subgroups between samples.

The following equation for the Equity Index that is used for this study:

$$Equity\ Index = \frac{x/n_x}{y/n_y}$$

Where:

x = number of students in the subgroup in the sample

n_x = number of students in the sample

y = number of students in the subgroup in the reference population

n_y = number of students in the reference population

The Equity Index reads, during time period, outcome of students who are demographic x was xxx% of that expected relative to the total reference population. Here is an example: *In the spring of 2012, enrollment of students who identify as Latino, in TAACCCT impacted programs, was 86% of that expected relative to the total student population of College A.*

Pearson's chi-square analysis. Pearson's chi-square tests are used to examine if the observed frequencies of two categorical variables are significantly different from expected frequencies of those categories. There are two types of comparisons that can be made using Pearson's chi-square test. The first type of analysis is a goodness-of-fit where expected frequencies are derived based on a theory. The second type of analysis is the test of independence where the expected frequency is calculated based on observed frequencies. In this study, Pearson's chi-square analyses are used as a test of independence. The assumptions for the Pearson's chi-square are that the individual observations are independent and that the individual cell size is greater than five. The formula for Pearson's chi-square analysis is:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where:

n = number of observations

O = observed count

E = expected count

The degrees of freedom equals the number of categories in the first variable (columns) minus one multiplied by the number of categories (rows) in the second variable minus one or df = (rows-1)(columns-1). Chi-square analyses in this study were two tailed with an alpha of 0.05. Residuals in chi-square analyses were examined to identify cells that deviate significantly from the assumed model. If the chi-square analysis yields a significant result, post hoc analysis of adjusted residuals were used to identify the cells that are significantly different. Adjusted residuals were significant at the .05 level if they are less than -1.96 or more than 1.96, and are significant at the .01 level if they are less than -2.575 or more than 2.575.

Logistic regression analysis. Logistic regression analysis is an application of multiple regression used to explore the relationships between an outcome variable, the dependent variable, and two or more independent variables (Howell, 2007). Multiple regression analysis and logistic regression are forms of linear regression, where linear regression analysis is the prediction of the dependent variable based on one independent variable, multiple regression and logistic regression analysis are the prediction of the dependent variable based on two or more independent variables (Aron & Aron, 1994). Multiple regression and logistic regression analysis can be used in exploratory, descriptive, predictive and inferential, as well as causal research (Cohen, Cohen, West, & Aiken, 2003). This variation in use is based on the design of the study,

its purpose, and the associate's degree to which the study and its data conform to the underlying assumptions associated with multiple regression analysis (Cohen et al., 2003).

The logistic regression analysis equation used for this study was (Cohen et al., 2003):

$$ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = (B_1X_1 + B_2X_2 + \cdots + B_iX_i + B_0)$$

Regression analysis techniques result in likelihood estimates the odds ratios of the outcome occurring between included and excluded categories while holding other variables in the model constant. The categories included and excluded for each independent variable in the logistic regression analyses are outlined in Table 2.

Table 2
Independent Variables Included in the Logistic Regression Analyses

Independent Variable	**Included**	**Excluded**
Age	Students 25 years of age or older	Students under 25 years of age
Developmental Education Coursework	Completed developmental education coursework	No record of developmental education coursework
Gender	Male	Female
Pell eligibility	Eligible for Pell grants	Not eligible for Pell grant
Race/ethnicity	Black students, Latino students, other students	White students

Additionally, fixed effect analyses were used to reduce the omitted variable bias associated with unobserved coefficients associated with attending a specific H2P college and to understand the average effect associated with each individual college. Fixed effect analysis examines the variation within a variable, in this study the variation related to the college. For this analysis, dummy variables were utilized for each college, and the average effect of the college was calculated relative to an omitted college. The omitted college for the logistic regression analyses in this study was the lead college, CSTCC.

While the assumptions underlying logistic regression mirror those of multiple regression the diagnostic tests are different. Diagnostic tests for logistical regression examine the amount of model deviance and the overall fit of the model, where deviance is the "function of the differences between likelihood ratios" (Cohen et al., 2003). Diagnostic tests used in this study were the likelihood ratio, Nagelkerke R^2 and the Hosmer-Lemeshow index of fit, and the Wald test (Cohen et al., 2003).

Measures

Enrollment in a program of study for TAACCCT participants was assigned by OCCRL based on the students' course history. A listing of healthcare related courses that are unique to each health professions programs of study at H2P colleges was developed by OCCRL. This listing was based on a comprehensive review of the published curriculum plans for every health professions program of study offered at each H2P college in the fall of 2014. This included evaluating courses that are required for prerequisites and courses that meet program requirements around elective courses. Using this list of unique courses, OCCRL assigned H2P participant to programs of study, where any student who enrolled in a course unique to any health program of study provided at an H2P program of study was assigned to that program of study. Using this method students are frequently assigned multiple programs of study; however, OCCRL found this multiple assignment reflected students' progression through multiple programs of study and is reflective of students who were awarded multiple credentials during the three year period studies (Bragg et al., 2015).

This study uses a combination of the students declared program of study and the program of study assignment method developed by OCCRL. This study utilized the listing of unique courses for each health professions program of study developed by OCCRL. For this study, the courses included in the program of study assignment were limited to those courses taken by the student during the sample timeframe (e.g. 2008 - 2010, 2009 - 2011, and 2012 - 2014). Additionally, any program that was developed within the scope of work of H2P was eliminated from assignment for students in the comparison study. These assigned programs of study were used in combination with students declared program of study, to provide a more comprehensive measure of students' programs of study.

Program of study length was assigned in the study based on the curriculum plans collected by OCCRL of all of the health professions programs of study at the H2P colleges. Programs of study length were assigned based on the minimum number of credits that are necessary to receive the associated credential. This program of study length does not account for other completion requirements that could impact the time to completion for students. Programs of study were categorized into one of four lengths, wherein certificates are categorized by the minimum number of credits required to complete the program of study. The categories for certificates used in this study are adopted from Bosworth (2010) and Bragg et al., (2015). The four program length categories are a) very short-term certificates that require 12 or less credit hours, b) short-term certificate that require more than 12 credit hours but less than 30 credit hours, c) long-term certificates that require of 30 or more credit hours by less than 60 credit hours, and d) associate's degree programs. In cases where there was no assigned or declared program of study the student was assigned to program of study length unknown. In cases where a curriculum plan was not publically available and where there was not an assigned program of study, students were assigned as program of study length unknown. A listing of the 41 TAACCCT-funded programs of study at H2P colleges, the number of colleges that offered each TAACCCT-funded program, and the programs included in this study is provided in Appendix A.

This study examined the likelihood of retention and completion for each demographic group that reached four different potential outcomes. The four outcomes examined were the likelihood of being a) retained with no credential, b) awarded one or more certificates, c) awarded one or more credentials, and d) awarded one or more associate's degrees. A student was consider retained with no credential if they were enrolled in courses the final semester of their sample's timeframe and had not been awarded a credential during the sample timeframe.

Limitations

There are several limitations in this study which are described here and reiterated throughout this dissertation. The first limitation is that despite the depth of the data captured in the OCCRL datasets, there is limited data to indicate previous work experience of participants. Additionally, the secondary data sources do not include transfer data. This limitation impacts the validity of calculations of program completion. Students from different subgroups in the study may appear as having not completed the program of study if they transferred to another institution to complete their studies. Additionally, students who transfer to further educational programs following the completion of their programs may have lower post-graduation income as of factor of the opportunity costs associated with educational study.

The use of Pell eligibility status is an indicator of how students who were low-income and received Pell grants were retained and completed. However, students who are not Pell-eligible are not necessarily not ineligible because of their income. For all of the following reasons students who may be low-income may be ineligible for Pell grants:

- Not all students complete a Free Application for Federal Student Aid (FAFSA) application, without which they cannot receive Pell funding,
- Part-time students may be less likely to complete a FAFSA and receive Pell funding,
- Part-time students may not be enrolled in enough credits to qualify for Pell funding,
- Students who have been awarded a bachelor's degree are ineligible for Pell funding, and
- Students may be dual enrolled at multiple institutions but are only eligible to receive Pell grants from one institution at a time (Romano & Millard, 2005).

Additionally, students may not be listed as Pell-eligible because they have capped their Pell grant lifetime eligibility, which is roughly equivalent to six years of Pell grant (U.S. Department of Education, 2015).

Findings

This chapter presents the analyses of the differences in underserved student subgroups who enrolled in, were retained in, and who were awarded credentials in health professions programs of study at H2P colleges prior to and after the H2P colleges received TAACCCT funding. Specifically, this chapter examines following the research question:

> Were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges?
>
> a. What changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding?
> b. What changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding?

This chapter is organized into seven sections. The first section describes the population and sample. The second section describes the development of the dataset including variable creation and a description of missing data. The third section provides the results of the preliminary analysis of the assumptions of logistic regression analysis. The fourth section presents results of the analysis on the proportion of students in each underserved student subgroup who enrolled in health professions programs of study. The fifth section focuses on the likelihood of students reaching four potential outcomes in the three year timeframe for their sample. The sixth section provides a brief summary for highlighting key findings for each subgroup. The chapter concludes with a summary of the findings.

Population and Sample

The population of this study were students enrolled at community colleges in health professions programs of study. However, this study used a purposefully chosen sample frame that limits generalizability to this population. The sample frame for this study were the students that were included in the OCCRL evaluation of H2P. This included two groups of students. The first group of students were enrolled in health professions programs of study at H2P colleges between 2006 and 2011, before the consortium received TAACCCT funding. The second group are were enrolled in TAACCCT-funded health-professions programs of study at H2P colleges between January 1, 2012 and December 31, 2014.

All of the students for this study were enrolled in health professions programs of study at H2P colleges. This study included a sample of H2P TAACCCT participants that were enrolled in TAACCCT-funded programs of study in eight of the nine H2P co-grantee colleges, hereafter referred to as the participant sample, and a sample of students who attended the same eight colleges and were enrolled in health professions programs of study prior to the colleges receiving TAACCCT funding, hereafter referred to as the comparison sample. The ninth college in the consortium, Malcolm X College, was excluded from this study because a comparison sample of students was not available within the sampling frame. The eight H2P colleges with students included in the study were:

- Anoka-Ramsey Community College (ARCC), Coon Rapids, MN,
- Ashland Community and Technical College (ACTC), Ashland, KY,
- Cincinnati State Technical and Community College (CSTCC), Cincinnati, OH,
- El Centro College (ECC), Dallas, TX,
- Jefferson Community and Technical College (JCTC), Louisville, KY,

- Owens Community College (OCC), Perrysburg, OH,
- Pine Technical and Community College (PTCC), Pine City, MN, and
- Texarkana College (TC), Texarkana, TX.

The samples for this study were selected based a common set of criteria applied to the students' course records in the OCCRL evaluation database. The course record in the OCCRL evaluation database included 241,652 course level records. This included 181,458 courses spanning from 2006 to 2014 for the 8,673 comparison students in the data set; and 60,192 courses spanning from 2011 to 2014 for the 4,693 H2P participants in the data set. A total of 36,677 courses were excluded from the data set for the purposes of selecting samples for this study. The excluded courses were where: a) students withdrew from the course, b) the course was not-for-credit or developmental, or c) no final grade was assigned.

The comparison sample of 5,929 students included two subgroups of students who were engaged in health professions programs of study at H2P prior to the consortium receiving TAACCCT funding. The first groups of comparison students included 3,683 students who enrolled in health professions courses in 2008, and had who had no course records prior to 2008 in the course record (2005-2014). The timeframe for these students was 2008-2010. The second group of comparison students included 2,246 students who enrolled in health professions courses in 2009, and had who had no course records prior to 2009 in the course record (2005-2014). The timeframe for these students was 2009-2011. Courses taken and credentials awarded by students after their respective timeframe were excluded from this study. The demographics of the comparison sample are provided in Table 3.

Table 3

Frequency Distribution of Student Demographics in the Comparison Sample by College

Student Demographics	**Total**		**ARCC**		**ACTC**		**CSTCC**		**ECC**		**JCTC**		**OCC**		**PTCC**		**TXC**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	5,929	100	203	3.4	104	1.8	2,154	36.3	206	3.5	2,409	40.6	179	3	383	6.5	291	4.9
Age																		
< 25	2,821	47.6	80	39.4	35	33.8	1,181	54.8	73	35.4	1,017	42.2	91	50.8	181	47.3	163	56.0
≥ 25	3,106	52.4	122	60.1	69	66.3	972	45.1	133	64.6	1,392	57.8	88	49.2	202	52.7	128	44.0
Unknown	2	0	1	0.5	0	0	9	0	0	0	0	0	0	0	0	0	0	0
Developmental courses																		
None	3,905	65.9	203	100	84	80.8	705	32.7	188	91.3	2,027	84.1	122	68.2	381	99.5	195	67.0
Any	2024	34.1	0	0	20	19.2	1,449	67.3	18	8.7	382	15.9	57	31.8	2	0.5	96	33.0
Gender																		
Female	4,593	77.5	144	70.9	85	81.7	1,505	69.9	126	61.2	2,012	83.5	164	91.6	329	85.9	228	78.4
Male	1,243	21.0	59	29.1	19	18.3	558	25.9	80	38.8	396	16.4	15	8.4	53	13.9	63	21.6
Unknown	93	1.6	0	0	0	0	91	4.2	0	0	1	0	0	0	1	0.3	0	0
Pell eligibility																		
Eligible	2,708	45.7	44	21.7	73	70.2	1,078	50.0	40	19.4	1,161	48.2	34	19.0	234	61.1	44	15.1
Not eligible	3,221	54.3	159	78.3	31	29.8	1,076	50.0	166	80.6	1,248	51.8	145	81	149	38.9	247	84.9
Unknown	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Race/ethnicity																		
Black	1,238	20.9	12	5.9	2	1.9	590	27.4	36	17.5	547	22.7	0	0	12	3.1	39	13.4
Latino	141	2.4	5	2.5	0	0	24	1.1	32	15.5	57	2.4	7	3.9	10	2.6	6	2.1
Other	246	4.1	6	3	1	1	54	2.5	23	11.2	96	4	3	1.7	33	8.7	30	10.3
White	3,967	66.9	168	82.8	101	97.1	1,351	62.7	105	51	1,572	65.3	136	76	320	83.6	214	73.5
Unknown	337	5.7	12	5.9	0	0	135	6.3	10	4.9	137	5.7	33	18.4	8	2.1	2	0.7

Note. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

Students in the H2P participant sample were selected based on two criteria. First, participants were selected who enrolled in courses at the colleges during the 2012 calendar year. Second, participants were selected who were not enrolled in courses in 2011. Calendar year 2011 was the first year in the H2P participant course record. The participant sample consisted of 2,643 students who initiated coursework in one or more TAACCCT impacted health professions programs of study at an H2P college in 2012. The demographics of this sample are provided in Table 4. The timeframe for the H2P participant sample was 2012-2014. Courses taken and credentials awarded by this sample after this timeframe were excluded from this study. Students, in both samples, may have taken courses at the respective colleges prior to the time period recorded in the course record. However, all of the students sampled for this study were not enrolled in coursework at the college for a minimum of one calendar year prior to initiating the coursework used in selecting them for the study.

The one exception to the timeframes outlined for each sample was in regards to students' participation in developmental education. The timeframe for the developmental education variable was extended to include one additional year of coursework prior to the start of the timeframe for each sample. The reason for this extension of the timeframe was to ensure the developmental education variable included students who participated in development coursework prior to enrolling in credit bearing courses to allow for students. The timeframe used exclusively for identifying the developmental education coursework included in the developmental education variable were as follows:

- 2007 - 2010 for comparison students who initiated coursework in 2008,
- 2008 - 2011 for comparison students who initiated coursework in 2009, and
- 2011 - 2014 for the participant sample.

Table 4

Frequency Distribution of Student Demographics in the Participant Sample by College

Student Demographics	**Total**		**ARCC**		**ACTC**		**CSTCC**		**ECC**		**JCTC**		**OCC**		**PTCC**		**TXC**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	2,643	100	174	6.6	120	4.5	376	14.2	1199	45.4	220	8.3	232	8.8	144	5.4	178	6.7
Age																		
>25	1,144	43.3	80	46.0	67	55.8	125	33.2	544	45.4	75	34.1	106	45.7	47	32.6	100	56.2
25+	1,498	56.7	94	54.0	53	44.2	251	66.8	655	54.6	144	65.5	126	54.3	97	67.4	78	43.8
Unknown	1	0	0	0	0	0	0	0	0	0	1	0.5	0	0	0	0	0	0
Developmental courses																		
None	1,830	69.2	107	61.5	81	67.5	188	50	845	70.5	177	80.5	158	68.1	127	88.2	147	82.6
Any	813	30.8	67	38.5	39	32.5	188	50	354	29.5	43	19.5	74	31.9	17	11.8	31	17.4
Gender																		
Female	2,233	84.5	151	86.8	99	82.5	307	81.6	985	82.2	193	87.7	208	89.7	137	95.1	153	86
Male	407	15.4	23	13.2	21	17.5	68	18.1	213	17.8	26	11.8	24	10.3	7	4.9	25	14
Unknown	3	0.1	0	0	0	0	1	0.3	1	0	1	0.5	0	0	0	0	0	0
Pell Eligibility																		
Eligible	1,361	51.5	82	47.1	35	29.2	218	58.0	595	49.6	101	45.9	150	64.7	125	86.8	55	30.9
Not eligible	1,120	42.4	9	5.2	85	70.8	81	21.5	604	50.4	119	54.1	82	35.3	19	13.2	121	68
Unknown	162	6.1	83	47.7	0	0	77	20.5	0	0	0	0	0	0	0	0	2	1.1
Race/ethnicity																		
Black	565	21.4	1	0.6	2	1.7	214	56.9	197	16.4	60	27.3	30	12.9	4	2.8	57	32
Latino	459	17.4	4	2.3	3	2.5	3	0.8	417	34.8	9	4.1	13	5.6	1	0.7	9	5.1
Other	145	5.5	0	0	1	0.8	17	4.5	100	8.3	11	5	8	3.4	4	2.8	4	2.2
White	1,205	45.6	132	75.9	113	94.2	140	37.2	270	22.5	137	62.3	172	74.1	134	93.1	107	60.1
Unknown	269	10.2	37	21.3	1	0.8	2	0.5	215	17.9	3	1.4	9	3.9	1	0.7	1	0.6

Note. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

Development of the Dataset

The OCCRL evaluation dataset that contains all students' records was stored in a Microsoft Access file. This relational database consisted of a series of interrelated tables that contain participant demographics, course records, credentials, enhanced retention services records, employment, and earnings. Three of these tables containing students' demographics, course records, and credentials, included data that were used to create the dataset for this study. Across the three tables there were three variables that connected the records in each table. These variables were a unique student identifier called MatchID, the OCCRL sample identifier, and the college where the student was enrolled.

The demographic table included records for a total of 6,569 students who participated in H2P and a comparison sample of 8,673 students who participated in health professions programs at H2P colleges prior to the colleges receiving TAACCCT funding. There were a total of 33 variables in the demographic table; however, some of these variables were only available for students in OCCRL's H2P participant sample. Variables from demographic table that were used included the students' date of birth, gender, race, ethnicity, eligibility for Pell funding, program of study, and major.

The course record table included 241,650 student course records and 36 variables. Variables from the course table that were used included the developmental education course identifier, calendar year of the course, semester and term, credits earned, final grade, course name, course subject, course number, and assigned program of study for the participant sample. The third table was the credential table that included 18,431 records of credentials awarded to students and 17 variables. Variables from the credential table that were used either in variable creation or as existing include credential type, semester and term, and credential date.

The dataset for this study was initially developed, by the researcher, as a flat file in Excel with three worksheets. The first worksheet contained the student record data for both samples. This file was created through a series of queries performed on the OCCRL evaluation dataset described above. Once developed this worksheet was formatted and imported into SPSS for the Pearson's chi-square analysis and logistic regression analysis. The variables that were used in these analysis are described and operationally defined in the data dictionary provided in Table 5. Table 5 also indicates what variables were a) drawn directly from the OCCRL dataset exactly as is, b) OCCRL variables that were recoded to match the operational definition of this study, c) created using queries of the OCCRL dataset, or d) drawn from IPEDS data.

The IPEDS data that was used for this study was stored in the second worksheet in the Excel file. This worksheet contained data collected on the colleges compiled from the 2009 (July 1, 2008 - June 30, 2009) and 2013 (July 1, 2012 - June 30, 2013) IPEDS 12 Month Enrollment reports for each H2P college. This data was accessed from the IPEDS data center website (https://nces.ed.gov/ipeds/datacenter). The colleges' reports were located using the, look up an institution, function assigning the additional years of data to use final release data. Colleges were searched for by name and confirmed based on city and state for the college. All data was recorded and crosschecked by the college IPEDS Unite ID, to ensure consistency. The 12-Month Enrollment report was located for each college under reported data by year. Each 12-Month Enrollment report was downloaded as a PDF and the data recorded into the Excel worksheet. All data was compiled from Part A – Unduplicated Count: 12-month Unduplicated Count by Race and Ethnicity and Gender for the Year Academic Year (undergraduates).

Table 5

Data Dictionary of Variables, Operational Definitions, and Sources

Variable	Description	Operational Definition	Source
Age	Categorical independent variable calculated based on date of birth of the student and age as of January 1 of the sample year (2008, 2009, and 2012), and further categorized into traditional-age and nontraditional-age groups.	0. under 25 years of age 1. 25 years of age and older 9. age unknown	Created from demographic data in the OCCRL evaluation database
Any credential[1]	Dummy variable indicating if a student completed any credential in the three year timeframe for the sample.	0. no credential awarded 1. one or more credentials awarded	Coded based on credential data in OCCRL evaluation database
College	Categorical variable indicating the H2P college the participant attended.	1. CSTCC 2. ARCC 3. ACTC 4. ECC 5. JCTC 6. OCC 7. PTCC 8. TXC	Existing in the OCCRL evaluation database
Certificates awarded	Categorical variable specifying if the student was awarded any certificates during the sample timeframe.	0. no certificated awarded 1. one or more certificates awarded	Coded based on credential data in OCCRL evaluation database
Degree awarded	Categorical variable specifying if the student was awarded an associate's degree during the sample timeframe.	0. no associate's degree awarded 1. one or more associate's degrees awarded	Coded based on credential data in OCCRL evaluation database

Table 5 (cont.)
Data Dictionary of Variables, Operational Definitions, and Sources

Variable	Description	Operational Definition	Source
Developmental coursework	Dichotomous independent variable indicating if the student completed one or more developmental education courses	0. no record of developmental education coursework 1. completed one or more developmental education courses	Created from course data in OCCRL evaluation database
Gender	Categorical covariate indicating the students' sex.	1. male 2. female 9. unknown	Existing in the demographic data in the OCCRL evaluation database
Pell-eligible status	Categorical independent variable indicating if students are eligible for Pell grant funding.	0. not eligible for Pell grant funding 1. eligible for Pell grant funding 9. Pell grant status unknown	Existing in the demographic data in the OCCRL evaluation database
Program length	Categorical variable indicating length of the program differentiated by minimum credits required to complete the program of study.	1. very short-term certificate 2. short-term certificate 3. long-term certificate 4. associate's degree 5. multiple program of study lengths 6. program of study unknown	Coded based on definition of program length and course data in the OCCRL evaluation database
Race	Categorical independent variable indicating the students self-reported race.	1. White 2. Black 3. Latino 4. other 5. unknown	Coded based on demographic data in OCCRL evaluation database

Table 5 (cont.)
Data Dictionary of Variables, Operational Definitions, and Sources

Variable	Description	Operational Definition	Source
Reference population (for enrollment)	Discrete variable indicating the total number of students in each subgroup and college wide at each H2P college.	1, 2, 3, to X	Collected from IPEDS 12-Month Enrollment reports
Retained no credential	Categorical variable indicating that a student had not been awarded a credential as of the close of the sample time frame and was enrolled in the final semester of that timeframe. The time frame for each sample is as follows: • 2008 sample, 2008 - 2010, final semester Fall 2010, • 2009 sample, 2009 - 2011, final semester Fall 2011, • 2012 sample, 2012 - 2014, final semester Fall 2014.	0. earned credential or not retained 1. retained no credential	Created from course and credential data in the OCCRL evaluation database
Sample	Categorical variable used to indicate the sample the student is part of.	0. comparison Sample 1. participant Sample	Created from demographic and course data in the OCCRL evaluation database
Sample year	Categorical variable that indicates the year of enrollment for the student.	• 2008 • 2009 • 2012	Created from demographic and course data in the OCCRL evaluation database

Notes:
1. Certificates awarded, any credential, and associate's degree awarded include credentials awarded from any program at the H2P colleges including those outside of health professions.
2. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

IPEDS data collected included number of: a) Black, non-Hispanic males, b) Hispanic males, c) total male, d) Black, non-Hispanic females, e) Hispanic females, f) total females, and g) grand total. The IPEDS data was used as reference population data for the Equity Index analysis.

The third worksheet in the Excel dataset contained data on the H2P programs of study as collected by OCCRL. This worksheet was compiled from worksheets developed by the OCCRL staff. Variables included in this data were the program of study name, the college offering the program of study, the minimum number of credits required to complete the program of study, if the program of study was implemented or enhanced with TAACCCT funding, and a listing of courses unique to each program of study. Program of study data was used for assigning the programs of study students enrolled in and categorizing programs of study by length.

Missing data. Missing data are summarized by variable and sample in Table 6. The missing data in the traditional and nontraditional-age variables were negligible, and accounted for only 0.03% of the two samples. The missing data in the gender variable accounted for 1.6% of the comparison and 0.1% of the participant sample. While there were no missing data in the Pell eligibility variable for the comparison sample, 6.1% of the participant sample were missing the Pell eligibility variable. Lastly, the majority of the missing data were in the race and ethnicity variable, with 5.7% of the comparison sample missing data and 10.2% of the participant sample missing data. Across all four variables a total of 7.9% of the comparison sample and 11.9% of the participant sample were missing data in one or more of these four variables. Missing data was coded and flagged as missing in the data set, and respondents with missing data. Students with missing data in a variable included in an Equity Index calculation or Pearson's chi-square analysis, were dropped from the analysis. For this reason, the number of students included in each analysis varies based on the variables required for the analysis. All students with missing

data were dropped from the logistic regressions analyses. The number of participants included in each analysis is provided with the summary of findings related to this story.

Table 6
Summary of Missing Values by Sample and Variable

Demographic variable	Comparison sample (*n* = 5,929)			Participant sample (*n* = 2,643)		
	Number known	Number unknown	Percent unknown	Number known	Number unknown	Percent unknown
Age	5,927	2	0.0	2,642	1	0.0
Gender	5,836	93	1.6	2,640	3	0.1
Pell eligibility	5,929	0	0.0	2,634	162	6.1
Race/ethnicity	5,592	337	5.7	2,374	269	10.2
Total	5,497	432	7.9	2,361	282	11.9

Analysis of Assumptions

The assumptions for logistic regression analysis are different from that of linear regression. Binary logistic regression analysis with its dichotomous dependent variable is not held to the assumptions of normality or homoscedasticity that are used with linear regression (Stoltzfus, 2011). There are four assumptions inherent to logistic regression analysis. The first assumption is an independence of cases. Under this assumption, logistic regression analysis is not appropriate for data collected repeated measures, and special measures are needed for analysis of correlated data with logistic regression analysis techniques (Stoltzfus, 2011). The data for this study was unique (not duplicated), no repeated measures or other data was used that would violate the assumption of independence. The second assumption is that there is a linear relationship between the logit transformed dependent and independent variables (Stoltzfus, 2011). This assumption did not impact this study as there were no continuous independent variables included in the study. The third assumption is an absence of influential outliers (Stoltzfus, 2011). As this study relied on categorical data the influence of any potential

outlier was bounded by the categories used in each variable. As such this third assumption did not impact this study. The final assumption under logistic regression is the absence of multicollinearity.

Multicollinearity is where two or more independent variables that are included in the same regression model are highly related (Cohen et al., 2003). If one or more independent variables is highly predictive of another independent variable within a regression model, the resulting regression coefficients can be misleading (Cohen et al., 2003). The appropriate tests for assessing multicollinearity is dependent on the type of independent variables being evaluated for correlation. In the case of continuous independent variables, a correlation matrix and calculation of the variance inflation factor can be used to detect issues of multicollinearity (Cohen et al., 2003). In the case of ordinal independent variables or a combination of ordinal and continuous variables, a Spearman's correlation can be used to identify high levels of correlation. In the case of categorical variables, either Pearson's chi-square is used to identify two-way correlations or a loglinear analysis can be used to identify correlations between two or more independent variables.

The variables in this study, both independent and dependent, are categorical variables. Many of the independent variables in this study are demographic characteristic of the students with a low chance misspecification. However, due to intersections between such factors as race and poverty, it was anticipated that there would be some effects of multicollinearity on the logistic regression analyses. For example, there are higher levels of poverty among minoritized racial and ethnic populations, therefore a correlation between race and Pell eligibility was anticipated. A series of Pearson's chi-square tests of independent were conducted between pairs of independent variables for both the comparison and participant samples. These are presented in

Table 7 and Table 8. In cases where the chi-square analysis was statistically significant these tables include Cramer's V score and the specific significant cells. While these tables show a fair number of significant interactions between the independent variables, the Cramer's V score for most of these interactions would indicate that the effect size of these pairing range from a negligible associations to a weak associations (Kotrlik, Williams, & Jabor, 2011). Two interactions, both within the comparison sample, were moderate associations a) race/ethnicity and Pell eligibility and b) race and ethnicity and developmental education coursework. While the findings from this analysis indicated that there was some correlation between the independent variables, the effect of these correlations did not warrant modification to the model.

Table 7

Pearson Chi-Square Results for Analysis of the Independent Variables for the Comparison Sample (n = 5,929)

Independent Variables	Developmental courses	Gender	Pell eligibility	Race/ethnicity
Age (*n*)	5927	5834	5927	5592
x^2	$x^2(1) = 94.1$, $p = .000$, $\varphi_c = .13$	$x^2(1) = 12.0$, $p = .001$, $\varphi_c = .05$	$x^2(1) = 25.3$, $p = .000$, $\varphi_c = .07$	$x^2(3) = .1.0$, $p = .810$
Significant cells	≥ 25: + None** - Any**	≥ 25: - Male** + Female**	≥ 25: - Not eligible** + Eligible**	None
Developmental courses (*n*)		2836	5929	5592
x^2		$x^2(1) = 2.2$, $p = .14$	$x^2(1) = 141.8$, $p = .000$, $\varphi_c = .16$	$x^2(3) = 225.4$, $p = .000$, $\varphi_c = .20$
Significant cells		None	Any: - Not eligible** + Eligible**	Any: - White** + Black** - Other**
Male (*n*)			5836	5532
x^2			$x^2(1) = 83.85$, $p = .000$, $\varphi_c = .12$	$x^2(3) = 27.4$, $p = .000$, $\varphi_c = .07$
Significant cells			Male: + Not eligible** - Eligible**	Male: + White* - Black** + Other**
Pell eligibility (*n*)				5592
x^2				$x^2(3) = 417.5$, $p = .000$, $\varphi_c = .27$
Significant cells				Eligible: - White** + Black** - Other**

Note.

*$p < .05$, ** $p < .01$, based on the adjusted residual for each cell

Table 8

Pearson Chi-Square Results for Analysis of the Independent Variables for the Participant Sample (n = 2,643)

Independent Variables	Developmental courses	Gender	Pell eligibility	Race/ethnicity
Age (*n*)	2642	2640	2480	2374
x^2	$x^2(1) = 5.7$, $p = .017$, $\varphi_c = .05$	$x^2(1) = .3$, $p = .559$	$x^2(1) = .3$, $p = .594$	$x^2(3) = 86.7$, $p = .000$, $\varphi_c = .19$
Significant cells	≥ 25: - None* + Any*	None	None	≥ 25: + Black** - Latino**
Developmental courses (*n*)		2640	2481	2374
x^2		$x^2(1) = 3.5$, $p = .061$	$x^2(1) = 89.3$, $p = .000$, $\varphi_c = .19$	$x^2(3) = 61.3$, $p = .000$, $\varphi_c = .16$
Significant cells		None	Any: - Not Eligible** + Eligible**	Any: - White** + Black** - Latino** - Other**
Male (*n*)			2478	2372
x^2			$x^2(1) = 2.5$, $p = .116$	$x^2(3) = 2.8$, $p = .426$
Significant cells			None	None
Pell eligibility (*n*)				2231
x^2				$x^2(3) = 67.9$, $p = .000$, $\varphi_c = .17$
Significant cells				Eligible: - White** + Black** - Other*

Note.

*$p < .05$, ** $p < .01$, based on the adjusted residual for each cell

Enrollment

Equity Indexes and chi-square analyses were used to answer the first sub-question in the study. Specifically, what changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding*?* To answer this question, the analysis focused on the proportion of students in each underserved student subgroup who enrolled in health professions programs of study. Included in this analysis were a series of Equity Indexes that compared the proportion of Black students, Latino students, and male students in each sample to the colleges' overall student population at both the college and consortium levels (Tables 9 - 11). Equity Indexes were also used to compare the proportion of students in each underserved student subgroup enrolled in programs of study across the two samples (Table 12). This was followed by the results of chi-square analysis that compared the proportion of each of the subgroups in the study across the two samples (Table 13). The remaining tables compared underserved subgroups of students' enrollment in different length of programs of study (Tables 14 - 16).

Equity Index. Equity Indexes were developed showing the proportion of Black students, Latino students, and male students in both samples. This analysis was done with these three subgroups because of the availability of comparable data for each H2P college through the colleges' IPEDS Student Financial Aid and Net Price reports. Similar comparable data was not available for the remaining underserved subgroups included in this study. The number and percentage of Black students, Latino students, and male students in the comparison sample and participant sample, are provided in Table 9 and 10 respectively. This same information are provided for each subgroup college wide at the respective college and in combination across the H2P Consortium colleges.

There are three sets of Equity Indexes provided in Table 11. The first two sets of Equity Indexes compared the proportion of each subgroup in the comparison sample and participant samples with the proportion of the subgroup in the college-wide population. The third set of Equity Indexes compared the proportion of each Black students, Latino students, and male students between the two samples. The proportion of Black students in the comparison sample was 119% of what was expected relative to the 2009 college population at H2P colleges, and the proportion of in the participant sample was 104% of what was expected relative to the 2013 college population at H2P colleges. And, the Black students in the participant sample was 102% of what was expected relative to the comparison sample. There were two colleges, CSTCC and TXC where Black students in the participant sample were over 200% of what was expected based relative to the comparison sample.

The proportion of Latino students relative to the college populations was 45% of what was expected for the comparison sample and 175% of what was expected for the participant sample. The Latino students in the participant sample was 730% of what was expected relative to the comparison sample. This difference primarily reflects a change in the proportion of Latino students at ECC. ECC enrolled 32 of the 141 Latino students in the comparison sample. These 32 students represented 56% of what was expected relative to the 2009 college-wide population at ECC. In the participant sample ECC enrolled 417 of the 459 Latino students in the participant sample. These 417 students represented 101% of what was expected relative to the 2013 college-wide population at ECC.

The proportion of male students in both the comparison sample and the participant sample was less than expected, 45% and 34% respectively, relative to the populations served by the H2P colleges. Further, the proportion of male students in the participant sample was 74% of

what was expected relative to the comparison sample. While the proportion of males in the comparison sample at each college ranged from 15% to 122% of what was expected, the proportion of males in the participant sample at each college was equal to or less than 50% of what was expected.

Table 9

Frequency Distribution of Student Demographics in the Comparison Sample at H2P Colleges

H2P college	Comparison sample							College population (2009 IPEDS)						
	Number of students				Percent of students			Number of students				Percent of students		
	n	Black	Latino	Male	Black	Latino	Male	*n*	Black	Latino	Male	Black	Latino	Male
H2P	5,929	1238	141	1,243	20.9	2.4	21.0	105,377	18,550	6537	48,640	17.6	6.2	46.2
ARCC	203	12	5	59	5.9	2.5	29.1	11,044	659	170	4,267	6.0	1.5	38.6
ACTC	104	2	0	19	1.9	0	18.3	5,271	67	32	2,435	1.3	0.6	46.2
CSTCC	2,154	590	24	558	27.4	1.1	25.9	16,035	3,952	170	7,554	24.6	1.1	47.1
ECC	206	36	32	80	17.5	15.5	38.8	15,030	4,695	4191	4,789	31.2	27.9	31.9
JCTC	2,409	547	57	396	22.7	2.4	16.4	19,878	3,869	459	9,377	19.5	2.3	47.1
OCC	179	0	7	15	0	3.9	8.4	30,604	3,973	1346	17,393	13.0	4.4	56.8
PTCC	383	12	10	53	3.1	2.6	13.8	1,235	42	12	458	3.4	1.0	37.1
TXC	291	39	6	63	13.4	2.1	21.6	6280	1,293	157	2,367	20.6	2.5	37.7

Note.

Health Professions Pathways (H2P) consortium, Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

Table 10

Frequency Distribution of Student Demographics in the Participant Sample at H2P Colleges

H2P college	Participant sample							College population (2013 IPEDS)						
	Number of students				Percent of students			Number of students				Percent of students		
	n	Black	Latino	Male	Black	Latino	Male	*n*	Black	Latino	Male	Black	Latino	Male
H2P	2,643	565	459	407	21.4	17.4	15.4	102,726	21,186	10,188	45,457	20.6	9.9	44.3
ARCC	174	1	4	23	0.6	2.3	13.2	12,552	851	531	4,776	6.8	4.2	38.1
ACTC	120	2	3	21	1.7	2.5	17.5	5,304	83	55	2,447	1.6	1.0	46.1
CSTCC	376	214	3	68	56.9	0.8	18.1	16,052	5,019	282	8,064	31.3	1.8	50.2
ECC	1,199	197	417	213	16.4	34.8	17.8	19,333	6,120	6,645	6,930	31.7	34.4	35.8
JCTC	220	60	9	26	27.3	4.1	11.8	19,927	4,836	867	8,497	24.3	4.4	42.6
OCC	232	30	13	24	12.9	5.6	10.3	22,519	2,889	1,495	12,194	12.8	6.6	54.2
PTCC	144	4	1	7	2.8	0.7	4.8	1,681	34	29	571	2.0	1.7	34.0
TXC	178	57	9	25	32.0	5.1	14.0	5,358	1,354	284	1,978	25.3	5.3	36.9

Note.

Health Professions Pathways (H2P) consortium, Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

Table 11

Equity Indexes for Black Students, Latino Students, and Male Students in the Comparison and Participant Samples

H2P college	Comparison sample versus the college population (2009)			Participant sample versus the college population (2013)			Participant sample versus the comparison sample		
	Black	Latino	Male	Black	Latino	Male	Black	Latino	Male
H2P	1.19	0.38	0.45	1.04	1.75	0.35	1.02	7.30	0.74
ARCC	0.99	1.60	0.75	0.09	0.54	0.35	0.10	0.93	0.46
ACTC	1.51	-	0.40	1.07	2.41	0.38	0.87	-	0.96
CSTCC	1.11	1.05	0.55	1.82	0.45	0.36	2.08	0.72	0.70
ECC	0.56	0.56	1.22	0.52	1.01	0.50	0.94	2.24	0.46
JCTC	1.17	1.03	0.35	1.12	0.94	0.28	1.20	1.73	0.72
OCC	-	0.89	0.15	1.01	0.84	0.19	-	1.43	1.23
PTCC	0.92	2.69	0.37	1.37	0.40	0.14	0.89	0.27	0.35
TXC	0.65	0.83	0.57	1.27	0.95	0.38	2.39	2.45	0.65

Note.

Health Professions Pathways (H2P) consortium, Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)

Test of independence. The Pearson's chi-square tests of independence were conducted comparing the proportion of subgroups of students across the two samples (Table 12). All expected cell frequencies were greater than five. The subgroup composition of the two samples were statistically different across each of the subgroups analyzed. There was significantly more students in the participant sample as compared to the comparison sample who were a) 25 years and older, b) had no record of developmental education coursework, c) female, and d) Pell-eligible; however, all of these associations were very weak (φ_c = .04, .03, .07, and .08 respectively). The association with race/ethnicity was moderate (φ_c = .31). There were significantly more Latino students in the participant sample and significantly less White students than in the comparison sample.

The number and percentage of students who enrolled in each program of study length for the comparison sample and participant sample are provided in Tables 13 and 14 respectively. The majority of students in both samples were enrolled in associate's degree programs. Specifically 50.9% in the comparison sample and 56.9% in the participant sample were enrolled in associate's degree programs. Students who were enrolled in only a very short-term certificate programs of study and short-term certificate programs of study accounted for a combined total of less than 6% of the students in both the comparison and participant samples.

Table 12

Chi-Square Results by Student Demographics and Sample

Student Demographics	Comparison sample (*n* = 5,929)		Participant sample (*n* = 2,643)		Adjusted residual
	Count	%	Count	%	
Age, $n = 8569$, $x^2(1) = 13.561$, $p = .000$, $\varphi_C = .04$					
< 25	2,821	47.6	1,144	43.3	-3.7**
≥ 25	2,106	52.4	1,498	56.7	3.7**
Developmental courses, $n = 8572$, $x^2(1) = 9.414$, $p = .002$, $\varphi_C = .03$					
None	3,905	65.9	1,830	69.2	3.1**
Any	2,024	34.1	813	30.8	-3.1**
Gender, $n = 8476$, $x^2(1) = 40.118$, $p = .000$, $\varphi_C = .07$					
Female	4,593	78.7	2,233	84.6	6.3**
Male	1,243	21.3	407	15.4	-6.3**
Pell-eligible, $n = 8410$, $x^2(1) = 59.062$, $p = .000$, $\varphi_C = .08$					
Not Eligible	3,221	54.3	1,120	45.1	-7.7**
Eligible	2,708	45.7	1,361	54.9	7.7**
Race/ethnicity, $n = 7966$, $x^2(3) = 741.938$, $p = .000$, $\varphi_C = .31$					
Black	1,238	22.1	565	23.8	1.6
Latino	141	2.5	459	19.3	26.0**
White	3,967	70.9	1,205	50.8	-17.3**
Other	246	4.4	145	6.1	3.2**

Notes.

1. Adjusted residuals are reported for the participant sample.
2. *$p < .05$, ** $p < .01$
3. Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

Table 13

Frequency Distribution of Student Enrollment by Program of Study Length and Student Demographics of the Comparison Sample (n = 5,929)

Student demographics	Very short-term certificate		Short-term certificate		Long-term certificate		Associate's degree		Multiple program lengths		Program unknown	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	180	3.0	135	2.3	613	10.3	3,017	50.9	461	7.8	1,523	25.7
Age												
< 25	96	3.4	58	2.1	243	8.6	1,445	51.2	225	8.0	754	26.7
≥ 25	84	2.7	77	2.5	370	11.9	1,570	50.5	236	7.6	769	24.8
Unknown	0	0	0	0	0	0	2	100	0	0	0	0
Developmental courses												
None	103	2.6	122	3.1	494	12.7	2,201	56.4	338	8.7	647	16.6
Any	77	3.8	13	0.6	119	5.9	816	40.3	123	6.1	876	43.3
Gender												
Female	141	3.1	112	2.4	502	10.9	2,358	51.3	358	7.8	1,122	24.4
Male	32	2.6	23	1.9	107	8.6	634	51.0	99	8.0	348	28.0
Unknown	7	7.5	0	0	4	4.3	25	26.9	4	4.3	53	57.0
Pell-eligible												
Not eligible	101	3.1	88	2.7	303	9.4	1,683	52.3	225	7.0	821	25.5
Eligible	79	2.9	47	1.7	310	11.4	1,334	49.3	236	8.7	702	25.9
Race/ethnicity												
Black	49	4.0	18	1.5	144	11.6	571	46.1	64	5.2	392	31.7
Latino	2	1.4	1	0.7	26	18.4	65	46.1	6	4.3	41	29.1
White	109	2.7	98	2.5	373	9.4	2,094	52.8	346	8.7	947	23.9
Other	8	3.3	8	3.3	39	15.9	93	37.8	27	11.0	71	28.9
Unknown	12	3.6	10	3.0	31	9.2	194	57.6	18	5.3	72	21.4

Note.

Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

Table 14

Frequency Distribution of Student Enrollment by Program of Study Length and Student Demographics of the Participant Sample

Student demographics	Very short-term certificate		Short-term certificate		Long-term certificate		Associate's degree		Multiple program lengths		Program unknown	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	100	3.8	53	2.0	343	13.0	1,505	56.9	220	8.3	422	16.0
Age												
< 25	66	5.8	27	2.4	153	13.4	604	52.8	89	7.8	205	17.9
≥ 25	33	2.2	26	1.7	190	12.7	901	60.1	131	8.7	217	14.5
Unknown	1	100	0	0	0	0	0	0	0	0	0	0
Developmental courses												
None	66	3.6	40	2.2	283	15.5	1,050	57.4	130	7.1	261	14.3
Any	34	4.2	13	1.6	60	7.4	455	56.0	90	11.1	161	19.8
Gender												
Female	80	3.6	45	2.0	296	13.3	1,271	56.9	187	8.4	354	15.9
Male	19	4.7	8	2.0	47	11.5	232	57.0	33	8.1	68	16.7
Unknown	1	33.3	0	0	0	0	2	66.7	0	0	0	0
Pell-eligible												
Not eligible	36	3.2	32	2.9	159	14.2	605	54.0	72	6.4	216	19.3
Eligible	48	3.5	19	1.4	178	13.1	798	58.6	123	9.0	195	14.3
Unknown	16	9.9	2	1.2	6	3.7	102	63.0	25	15.4	11	6.8
Race/ethnicity [1]												
Black	16	2.8	9	1.6	70	12.4	303	53.6	95	16.8	72	12.7
Latino	24	5.2	4	0.9	51	11.1	234	51.0	20	4.4	126	27.5
White	50	4.1	36	3.0	186	15.4	771	64.0	91	7.6	71	5.9
Other	1	0.7	2	1.4	15	10.3	103	71.0	10	6.9	14	9.7
Unknown	9	3.3	2	0.7	21	7.8	94	34.9	4	1.5	139	51.7

Note.

Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

Comparison sample. Chi-square tests of independence were conducted comparing the frequency of each demographic variable and the length of programs of study students in the comparison sample were enrolled in (Table 15). In the analysis of race two cells (8.3%) had an expected count of less than five. In all other analysis there were no cells with an expected count of less than five. The length of the programs of study that students enrolled in were statistically significantly for each demographic subgroup. There was a moderate association between students completion of developmental education coursework and the length of program of study that they enrolled in ($\varphi_c = .31$). There were weak associations between all remaining demographic subgroups, including age, gender, Pell-eligible, and race/ethnicity, and the length of program of study that students enrolled in. A statistically larger proportion of students who had completed developmental education coursework enrolled in very short-term certificate programs of study. While a statistically smaller proportion of these students were enrolled in longer programs of study including short-term certificate, long-term certificate, and associate's degree programs. A statistically smaller proportion of males enrolled in long-term certificates. A statistically larger proportion of students who were Pell-eligible enrolled in short-term certificates and multiple programs of different lengths.

The program of study length that students in the comparison sample enrolled in varied by race. A larger proportion of Black students enrolled in very short-term certificate program of studies, while a smaller a proportion of Black students enrolled in short-term certificate programs of study, associate's degree programs of study, and multiple programs of study of different lengths. A larger proportions of both Latino students and students categorized as other race were enrolled in long-term certificate programs of study, while a smaller proportion of White students were enrolled in long-term certificate programs of study.

Table 15

Pearson Chi-Square Results and Adjusted Residuals of Student Enrollment for the Comparison Sample (n = 5,929) by Program of Study Length and Student Demographics

Student demographics	**Adjusted residuals**					
	Very short-term certificate	Short-term certificate	Long-term certificate	Associate's degree	Multiple program lengths	Program unknown
Age, n = 5592, $x^2(5) = 21.724$, p = .001, φ_c = .06						
< 25	1.6	-1.1	-4.2**	0.5	0.5	1.7
≥ 25	-1.6	1.1	4.2**	-0.5	-0.5	-1.7
Developmental courses, n = 5929, $x^2(5) = 550.311$, p = .000, φ_c = .31						
None	-2.5*	6.1**	8.1**	11.7**	3.5**	-22.3**
Any	2.5*	-6.1**	-8.1**	-11.7**	-3.5**	22.3**
Gender, n = 5836, $x^2(5) = 12.328$, p = .031, φ_c = .05						
Female	0.9	1.2	2.4*	0.2	-0.2	-2.6**
Male	-0.9	-1.2	-2.4*	-0.2	0.2	2.6**
Pell-eligible, n = 5929, $x^2(5) = 20.923$, p = .001, φ_c = .06						
Not eligible	0.5	2.6**	-2.6**	2.3*	-2.5*	-0.4
Eligible	-0.5	-2.6**	2.6**	-2.3*	2.5*	0.4
Race/ethnicity[2], n = 5592, $x^2(15) = 95.244$, p = .000, φ_c = .08						
Black	2.2*	-2.1*	1.6	-3.5**	-4.1**	5.2**
Latino	-1.1	-1.2	3.2**	-1.1	-1.6	0.9
White	-1.8	1.9	-3.8**	5.4**	3.5**	-5.5**
Other	0.2	1.1	2.9**	-4.1**	1.8	1.1

Notes.

1. *p < .05, ** p < .01
2. Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

Additionally, a larger proportion of White students enrolled in associate's degree programs of study and multiple programs of study of different lengths. Finally, a smaller proportion of students categorized as other were enrolled in associate's degree programs of study.

Participant sample. Chi-square tests of independence were conducted comparing the frequency of each demographic variable and the length of programs of study students in the participant sample were enrolled in (Table 16). In the analysis of race one cell (4.2%) had an expected count of less than five. In all other analysis there were no cells with an expected count of less than five. The length of the programs of study that students enrolled in were statistically significant with a weak association (φ_c ranges from 0.10 to 0.18). A larger proportion of traditional-aged students were enrolled in very short-term certificate programs of study, where a larger proportion of nontraditional-aged students were enrolled in associate's degree programs of study. The analysis showed that a larger proportion of students who had no record of developmental education coursework were enrolled in long-term certificate programs of study, where a larger proportion of student who completed developmental education coursework were enrolled in multiple programs of study of different program lengths. Likewise, a larger proportion of students who were Pell-eligible were enrolled in associate's degree programs of study and multiple programs of study of different lengths, where a larger proportion of students who were not Pell-eligible were enrolled in short-term certificate programs of study.

The length of the program of study that students in the comparison sample enrolled in varied by race. A larger proportion of Black students enrolled in multiple programs of study of different lengths, and a smaller proportion of Black students enrolled in associate's degree programs of study. A smaller proportion of Latino students enrolled in short-term certificate,

Table 16

Pearson Chi-Square Results and Adjusted Residuals of Student Enrollment for the Participant Sample (n = 2,643) by Program of Study Length and Student Demographics

Student demographics	**Adjusted residuals**					
	Very short-term certificate	Short-term certificate	Long-term certificate	Associate's degree	Multiple program lengths	Program unknown
Age, n = 2642, $x^2(5) = 35.180$, p = .000, $\varphi_c = .12$						
< 25	4.8**	1.1	0.5	-3.8**	-0.9	2.4*
≥ 25	-4.8**	-1.1	-0.5	3.8**	0.9	-2.4*
Developmental courses, n = 2643, $x^2(5) = 51.468$, p = .000, $\varphi_c = .14$						
None	-0.7	1.0	5.7**	0.7	-3.4**	-3.6**
Any	0.7	-1.0	-5.7**	-0.7	3.4**	3.6**
Gender, n = 2640, $x^2(5) = 2.046$, p = .843						
Female	-	-	-	-	-	-
Male	-	-	-	-	-	-
Pell-eligible, n = 2481, $x^2(5) = 23.875$, p = .000, $\varphi_c = .10$						
Not eligible	-0.4	2.6**	0.8	-2.3*	-2.4*	3.3**
Eligible	0.4	-2.6**	-0.8	2.3*	2.4*	-3.3**
Race/ethnicity[2], n = 2374, $x^2(15) = 222.339$, p = .000, $\varphi_c = .18$						
Black	-1.4	-1.0	-1.7	-3.2**	7.3**	0.7
Latino	1.7	-2.1*	-1.7	-4.1**	-3.9**	11.4**
White	0.8	2.9**	2.7**	4.6**	-2.7**	-9.2**
Other	-2.0*	-0.7	-1.2	2.9**	-1.0	-0.9

Notes.

1. *p < .05, ** p < .01
2. Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

associate's degree, and multiple programs of study of different lengths. A larger proportion of White students enrolled in short-term certificate, long-term certificate, and associate's degree programs of study, while a smaller proportion enrolled in multiple programs of study of different lengths. Finally, a larger proportion of students categorized as other race enrolled in associate's degree programs of study, while a smaller proportion enrolled in very short-term certificate programs of study.

Educational Outcomes

This section addresses the second sub-question in the study. This sub-question was: what changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding? This section focuses on the likelihood of that students reached four potential outcomes within the three year timeframe for their sample. The educational outcomes included in this study were a) retained without a credential, b) awarded one or more certificates, c) awarded one or more associate's degrees, and d) awarded one or more credentials. The first table in this section (Table 19) provides the frequency and percentage of each student for each educational outcome. The next four tables outline the findings from the logistic regression analyses that were used to examine the likelihood that these underserved subgroups of students in each sample achieved each of the educational outcomes in the study (Tables 18 - 21). The final table in this section contains the findings from a logistic regression analysis of the likelihood of underserved students were awarded one or more associate's degrees, where the sample was restricted to those students who were enrolled in associate's degree programs (Table 22). Nagelkerke R^2 and the Hosmer and

Lemeshow goodness of fit analyses were completed for each logistic regression. The results of these tests are included in the related logistic regression tables.

Retained without credential. Students who were retained without a credential were students who took courses at the college in the final semester of the samples three year timeframe, and who during that time had not been awarded a credential from the college. These students made up 24.2% of the comparison sample and 25.1% of the participant sample (Table 17). The largest difference in the percentage of a subgroup between the comparison sample and the participant sample was among Latino students. In the comparison sample, 34 students (24.2%) were retained without a credential. In the participant sample, 207 (45.1%) were retained without a credential.

A set of three logistic regressions analyses were performed to ascertain the effects of age, developmental education coursework, gender, Pell eligibility, race/ethnicity, and college on the likelihood that students were retained at the college without being awarded credential at the end of the sample timeframe. The first logistic regression analysis was performed with the comparison and participant samples combined, and included the sample as a variable in the model. This logistic regression was specifically intended to demonstrate if students in one sample had a higher likelihood of being retained at the college without being awarded a credential. The logistic regression model for the combined sample was $x^2(15) = 760.03$, $p = .000$, $n = 7{,}759$. There were 813 students with missing values that were excluded from this analysis. The model explained 14% (Nagelkerke R^2) of the variance in retention and correctly classified 76.1% of cases. The results of the post hoc Hosmer and Lemeshow goodness of fit test was $H(8) = 20.17$, $p = .010$.

Table 17

Frequency Distribution of Students' Educational Outcomes by Demographics of Sample

Student demographics	**Comparison sample, *n* = 5,929**								**Participant sample, *n* = 2,643**							
	Retained no credential		Awarded 1+ certificates		Awarded 1+ credential		Awarded 1+ degree		Retained no credential		Awarded 1+ certificates		Awarded 1+ credential		Awarded 1+ degree	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	1,433	24.2	791	13.3	1,747	29.5	1,051	17.7	664	25.1	741	28.0	1,068	40.4	403	15.2
Age																
< 25	694	24.6	333	11.8	676	24.0	381	13.5	328	28.7	336	29.4	436	38.1	127	11.1
≥ 25	739	23.8	458	14.7	1,070	34.4	669	21.5	336	24.4	405	27.0	632	42.2	276	18.4
Unknown	0	0.0	0	0.0	1	50.0	1	50.0	0	0.0	0	0.0	0	0.0	0	0.0
Developmental courses																
None	691	17.7	661	16.9	1,581	40.5	1,010	25.9	412	22.5	537	29.3	830	45.4	357	19.5
Any	742	36.7	130	6.4	166	8.2	41	2.0	282	34.7	204	25.1	238	29.3	46	5.7
Gender																
Female	1,118	24.3	861	18.7	1,375	29.9	861	18.7	582	26.1	639	28.6	924	41.4	350	15.7
Male	290	23.3	186	15.0	365	29.4	186	15.0	112	27.5	101	24.8	143	35.1	53	13.0
Unknown	25	26.9	4	4.3	7	7.5	4	4.3	0	0.0	1	33.3	1	33.3	0	0.0
Pell-eligible																
Not eligible	805	25.0	452	14.0	1,058	32.8	649	20.1	287	25.6	270	24.1	420	37.5	179	16.0
Eligible	628	23.2	339	12.5	689	25.4	402	14.8	378	27.8	429	31.5	573	42.1	190	14.0
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	29	17.9	42	25.9	75	46.3	34	21.0
Race/ethnicity																
Black	282	22.8	147	11.9	245	19.8	118	9.5	118	20.9	167	29.6	215	38.1	56	9.9
Latino	34	24.1	28	19.9	50	35.5	23	16.3	207	45.1	58	12.6	101	22.0	44	9.6
White	974	24.6	560	14.1	1,288	32.5	794	20.0	189	15.7	473	39.3	670	55.6	264	21.9
Other	57	23.2	32	13.0	69	28.0	42	17.1	50	34.5	22	15.2	48	33.1	26	17.9
Unknown	86	25.5	24	7.1	95	28.2	74	17.7	130	48.3	21	7.8	34	12.6	13	4.8

Note. Students who identified as ethnically Latino were included in the Latino category regardless of the additional racial categories they selected. All other racial categories included only non-Latino students. The category *other* included: American Indian, Alaskan Native, Asian, Multiple Races, Pacific Islander, and Native Hawaiian.

The difference in the likelihood of being retained at the college between the participant sample and the comparison sample was significant (p = .000). Students in the comparison sample had 1.90 times higher odds, than students in the comparison sample, of being retained at the college without being awarded a credential at the end of the sample timeframe.

The remaining two logistic regression analyses of the likelihood that students were retained at the college without being awarded credential at the end of their sample timeframe were conducted separately for the comparison and participant samples (Table 18). The logistic regression model for the comparison sample was $x^2(14) = 511.57$, p = .000. The model correctly classified 75.8% of cases. There were three statistically significant finding in this analysis. Students who took developmental education courses were 1.81 times higher odds of being retained at the college without a credential at the end of the sample timeframe. Females had a 1.30 times higher odds of being retained without a credential at the end of the sample timeframe. Lastly, Whites students were 1.33 times higher odds of being retained without a credential at then the end of the sample timeframe than Black students.

The logistic regression model for the participant sample was $x^2(14) = 355.82$, p = .000. The model correctly classified 77.2% of cases. There were four statistically significant findings in this analysis. Students who took developmental education courses and students who were Pell-eligible were 1.98 times and 1.30 times respectively higher odds of being retained at the college without a credential at the end of the sample timeframe. Likewise, Latino students and students classified as other race had 1.74 and 1.80 times respectively higher odds of being retained at the college.

Table 18

Logistic Regression Analyses of Students Being Retained For Three Years Without Earning a Credential Based on Age, Developmental Education Coursework, Gender, Pell Eligibility, Race/Ethnicity, and College

Student demographics (comparison)	**Comparison sample, *n* = 5,530, *df* = 1**					**Participant sample, *n* = 2,229, *df* = 1**				
	B	SE	Wald	*p*	Odds ratio	*B*	SE	Wald	*p*	Odds ratio
Constant	-.74	.09	69.72	.000	.48	-2.19	.22	95.49	.000	.112
Age										
≥ 25 (< 25)	.11	.07	2.84	.092	1.12	-.15	.11	1.81	.179	.860
Developmental courses										
Any (None)	.59	.08	54.43	.000	1.81	.68	.12	32.74	.000	1.98
Gender										
Male (Female)	-.28	.08	11.04	.001	.77	.03	.15	.03	.856	1.03
Pell-eligible										
Yes (No)	-.13	.07	2.94	.087	.88	.26	.12	4.95	.026	1.30
Race/ethnicity (White)										
Black	-.29	.09	10.76	.001	.75	.06	.16	.17	.684	1.07
Latino	-.05	.22	.05	.823	.95	.55	.16	12.79	.000	1.74
Other	.07	.17	.16	.690	1.07	.59	.21	7.56	.006	1.80
College (CSTCC)										
ARCC	-.18	.18	1.03	.311	.83	.74	.33	5.18	.023	2.10
ACTC	-.65	.25	6.59	.010	.53	.42	.30	1.88	.171	1.52
ECC	-.13	.18	.52	.471	.89	1.21	.19	39.87	.000	3.34
JCTC	-1.21	.09	186.10	.000	.30	-.329	.29	1.32	.251	.72
OCC	.17	.18	.84	.360	1.18	-1.12	.45	10.47	.001	.33
PTCC	-1.30	.18	50.85	.000	.27	-1.21	.46	6.87	.009	.30
TXC	-.45	1.5	9.18	.002	.64	-.23	.31	.56	.456	.80

Note.

1. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)
2. Comparison Sample: Nagelkerke R^2 = .132, H(8) = 12.19, p = .143; Participant sample: Nagelkerke R^2 = .220, H(8) = 4.40, p = .495

Awarded one or more certificates. Students who reached this educational outcome had both earned and been awarded by the college one or more certificates. This category did not include students who had completed the requirements for a certificate but were not awarded the credential within the sample timeframe. For example, students who were enrolled in multiple programs of study may delay in applying for graduation until they have completed their studies, and are awarded multiple credentials at that time. This category also did not reflect students who were awarded credentials or certifications from entities other than the colleges. Students who earned one or more certificates made up 11.8% of the comparison sample and 28.0% of the participant sample (Table 17). A larger percentage of most subgroups in the participant sample were awarded a certificate, with most subgroups having a growth exceeding 10% over that of the comparison sample. The largest percentage difference was for White students, 45.4% of White students in the participant sample were awarded one or more certificates, 25.2% more than in the comparison sample.

A set of three logistic regressions analyses were performed to ascertain the effects of age, developmental education coursework, gender, Pell eligibility, race and ethnicity, and college on the likelihood that students were awarded one or more certificates within the sample timeframe. The first logistic regression analysis was performed with the comparison and participant samples combined, and included the sample as a variable in the model. This logistic regression was specifically intended to demonstrate if students in one sample had a higher likelihood of being awarded students were awarded one or more certificates. The logistic regression model for the combined sample was $x^2(15) = 968.52$, $p = .000$, $n = 7{,}759$. There were 813 students with missing values that were excluded from this analysis. The model explained 19% (Nagelkerke R^2) of the variance in retention and correctly classified 83% of cases. The results of the post hoc

Hosmer and Lemeshow goodness of fit test was $H(8) = 62.40$, $p = .000$. The difference in the likelihood of students being awarded one or more certificates between the participant sample and the comparison sample was significant ($p = .000$). Students in the participant sample had 4.56 times higher odds, than students in the comparison sample, of being awarded one or more certificates.

The remaining two logistic regression analyses of the likelihood that students were awarded one or more certificates by the end of the sample timeframe were conducted separately for the comparison and participant samples (Table 19). The logistic regression model for the comparison sample was $x^2(14) = 510.82$, $p = .000$. The model correctly classified 86.5% of cases. There were three statistically significant findings in this analysis. Students who did not take developmental education courses and male students had 1.30 times and 1.64 times, respectively, higher odds of earning one or more certificates. Lastly, Whites students had 1.72 times higher odds of earning one or more certificates than Black students.

The logistic regression model for the participant sample was $x^2(14) = 678.78$, $p = .000$. The model correctly classified 76.4% of cases. There were three statistically significant findings in this analysis. First students of traditional-age had 1.56 times higher odds of earning one or more certificates. White students had 1.59 times higher odds of being awarded one or more certificates than Black students and 1.92 times higher odds than students classified as *other* race.

Table 19

Logistic Regression Analyses of Students Being Awarded One or More Certificates on Age, Developmental Education Coursework, Gender, Pell Eligibility, and Race and Ethnicity

Student Demographics (Comparison)	**Comparison Sample, *n* = 5,530, *df* = 1**					**Participant Sample, *n* = 2,229, *df* = 1**				
	B	SE	Wald	*p*	Odds Ratio	*B*	SE	Wald	*p*	Odds Ratio
Constant	-3.29	.16	452.70	.000	.04	.57	.19	8.69	.003	1.76
Age										
≥ 25 (< 25)	.14	.08	2.76	.096	1.15	-.45	.12	15.47	.000	.64
Developmental courses										
Any (None)	-.27	.12	5.10	.024	.77	-.22	.13	3.04	.081	.801
Gender										
Male (Female)	.50	.10	25.06	.000	1.64	.066	.16	.17	.677	1.07
Pell-eligible										
Yes (No)	.02	.09	.03	.861	1.02	.19	.12	2.58	.108	1.22
Race/ethnicity (White)										
Black	.08	.11	.51	.476	1.08	-.46	.15	9.82	.002	.63
Latino	-.09	.24	.13	.718	.92	.07	.21	.10	.752	1.07
Other	-.55	.21	7.16	.007	.58	-.66	.28	5.61	.018	.52
College (CSTCC)										
ARCC	-.81	.53	2.35	.125	.45	-2.78	.45	37.54	.000	.06
ACTC	1.09	.34	10.53	.001	2.98	-1.55	.27	33.98	.000	.21
ECC	2.73	.20	179.15	.000	15.32	-2.84	.21	185.11	.000	.06
JCTC	1.54	.14	115.53	.000	4.66	-.10	.19	.253	.615	.91
OCC	1.55	.27	33.52	.000	4.69	.18	.20	.88	.349	1.20
PTCC	2.50	.18	192.68	.000	7.63	.66	.25	7.17	.007	1.93
TXC	2.03	.19	114.61	.000	7.63	-.66	.21	9.75	.002	.52

Note.

1. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)
2. Comparison Sample: Nagelkerke R^2 = .160, H(8) = 28.89, p = .000; Participant sample: Nagelkerke R^2 = .371, H(8) = 8.16, p = .418

Awarded one or more credentials. Students who reached this educational outcome had earned and been awarded by the college one or more certificates or associate's degrees. This category did not include students who had completed the requirements for a certificate or associate's degree but who were not awarded the credential within the sample timeframe. The category also did not include any credential awarded by entities other than the college. Students who were awarded one or more credentials made up 29.5% of the comparison sample and 40.4% of the participant sample (Table 17). The largest percentage increases between subgroups within the comparison and participant samples were students who had taken developmental education courses (21.1% increase), White students (23.1%), Black students (18.3% increase), and Pell-eligible students (16.7% increase). In contrast there was a decrease in the percentage of Latino students who were awarded one or more credentials (13.5% decrease).

Three logistic regressions analyses were performed to ascertain the effects of age, developmental education coursework, gender, Pell eligibility, race and ethnicity, and college on the likelihood that students were awarded one or more credentials within the sample timeframe. The first logistic regression analysis was performed with the comparison and participant samples combined, and included the sample as a variable in the model. This logistic regression was specifically intended to demonstrate if students in one sample had a higher likelihood of being retained at the college without being awarded a credential. The logistic regression model for the combined sample was $x^2(15) = 1399.75$, $p = .000$, $n = 7{,}759$. There were 813 students with missing values that were excluded from this analysis. The model explained 23% (Nagelkerke R^2) of the variance in retention and correctly classified 72% of cases. The results of the post hoc Hosmer and Lemeshow goodness of fit test was $H(8) = 46.36$, $p = .000$. The difference in the likelihood of being retained at the college between the comparison sample and participant

sample was significant (p = .000). Students in the participant sample had 3.12 times higher odds, than students in the comparison sample, of being awarded one or more certificates.

The remaining two logistic regression analyses examined the likelihood that students were awarded one or more credentials by the end of the sample timeframe for the comparison and participant samples (Table 20). The logistic regression model for the comparison sample was $x^2(14) = 607.18$, p = .000. The model correctly classified 72.6% of cases. There were five statistically significant findings in this analysis. Students who had no record of developmental education courses, were nontraditional-age students, and who were not eligible for Pell funding had 3.45, 1.41, and 1.16 times, respectively, higher odds of earning one or more credentials. White students had 1.56 times higher odds than Black students and students classified as other race.

The logistic regression model for the participant sample was $x^2(14) = 1073.47$, p = .000. The model correctly classified 73% of cases. There were three statistically significant findings in this analysis. Students who did not take developmental education courses had 2.31 times higher odds of earning one or more credentials. White students had higher odds of earning one or more credentials than Black students and Latino students, 1.69 and 1.56 times higher odds respectively.

Table 20

Logistic Regression Analyses of Students Being Awarded One or More Credentials Based on Age, Developmental Education Coursework, Gender, Pell Eligibility, and Race and Ethnicity

Student demographics (comparison)	**Comparison sample, *n* = 5,530, *df* = 1**					**Participant sample, *n* = 2,229, *df* = 1**				
	B	SE	Wald	*p*	Odds ratio	*B*	SE	Wald	*p*	Odds ratio
Constant	-1.68	.10	260.90	.000	.19	.82	.18	19.91	.000	2.2
Age										
≥ 25 (< 25)	.35	.07	27.28	.000	1.41	.02	.10	.04	.849	1.02
Developmental courses										
Any (None)	-1.25	.10	160.52	.000	.29	-.86	.12	52.08	.000	.42
Gender										
Male (Female)	.11	.08	1.92	.166	1.12	-.10	.14	.52	.47	.91
Pell-eligible										
Yes (No)	-.15	.07	4.81	.028	.86	.03	.11	.06	.801	1.03
Race/ethnicity (White)										
Black	-.44	.09	23.43	.000	.64	-.50	.13	13.87	.000	.61
Latino	-.18	.20	.817	.366	.84	-.45	.16	7.70	.006	.64
Other	-.44	.16	7.96	.005	.64	-.40	.21	3.52	.061	.67
College (CSTCC)										
ARCC	1.39	.17	64.89	.000	4.01	-.55	.28	3.77	.052	.58
ACTC	1.15	.23	25.00	.000	3.14	-1.74	.27	43.09	.000	.18
ECC	1.89	.18	117.00	.000	6.65	-1.58	.17	90.26	.000	.21
JCTC	1.56	.10	251.91	.000	4.76	.01	.20	.002	.965	1.01
OCC	1.02	.21	24.26	.000	2.77	1.10	.22	24.70	.000	3.00
PTCC	.95	.15	43.10	.000	2.60	1.32	.30	19.19	.000	3.74
TXC	-1.09	.16	46.57	.000	2.96	-.39	.21	3.46	.063	.68

Note.

1. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)
2. Comparison Sample: Nagelkerke R^2 = .320, H(8) = 19.65, p = .000; Participant sample: Nagelkerke R^2 = .251, H(8) = 6.06, p = .000

Awarded one or more associate's degrees. Students who reached this educational outcome had both earned and been awarded by the college one or more associate's degrees. This category did not capture students who had completed the requirements for an associate's degree but were not awarded the associate's degree within the sample timeframe. Students who completed one or more associate's degrees made up 17.7% of the comparison sample and 15.2% of the participant sample (Table 17). The largest percentage differences for subgroups between the comparison and participant sample were Latino students with a 6.7% decrease and students who had not taken developmental education courses with a 6.4% decrease.

Two sets of logistic regression analyses were performed to ascertain the effects of age, developmental education coursework, gender, Pell eligibility, race and ethnicity, and college on the likelihood that students were awarded an associate's degree within the sample timeframe. The first set of analysis included three logistic regression analysis. The first logistic regression analysis was performed with the comparison and participant samples combined, and included the sample as a variable in the model. This logistic regression analysis was specifically intended to demonstrate if students in one sample had a higher likelihood of being awarded one or more associate's degrees. This was followed by two logistic regression analyses the likelihood that students in each sample, separately, were awarded one or more associate's degrees (Table 21). The second set of logistic regression analysis restricted each sample to those students who were enrolled in an associate's degree program (Table 22).

The logistic regression model for the combined sample was $x^2(15) = 1206.50$, $p = .000$, $n = 7{,}759$. There were 813 students with missing values that were excluded from this analysis. The model explained 24% (Nagelkerke R^2) of the variance in retention and correctly classified 82.6% of cases. The results of the post hoc Hosmer and Lemeshow goodness of fit test was

$H(8) = 21.23$, $p = .007$. The difference in the likelihood of being retained at the college between the participant sample and the comparison sample was significant ($p = .007$). Students in the participant sample had 1.28 times higher odds, than students in the comparison sample, of being students were awarded one or more associate's degrees.

The logistic regression model for the comparison sample was $x^2(14) = 1127.78$, $p = .000$ (Table 21). The model correctly classified 82.2% of cases. There was four statistically significant findings in this analysis. Nontraditional-aged students and females had 1.48 times higher odds of earning one or more associate's degrees. Students who did not take developmental education courses had 10.00 times the odds of earning one or more associate's degrees. Lastly, White students had 2.04 times higher odds than Black students of earning one or more associate's degrees.

The logistic regression model for the participant sample was $x^2(14) = 255.21$, $p = .000$ (Table 19). The model correctly classified 83.8% of cases. There were four statistically significant findings in this analysis. Nontraditional-age students had 1.60 times higher odds of earning one or more associate's degrees. Students who did not take developmental education courses had 4.76 times higher odds of earning one or more associate's degrees. White students had 1.69 times higher odds than Black students and 2.08 times higher odds than Latino students of earning one or more associate's degrees.

Table 21

Logistic Regression Analyses of Students Being Awarded One or More Associate's Degrees Based on Age, Developmental Education Coursework, Gender, Pell Eligibility, and Race and Ethnicity

Student demographics (comparison)	**Comparison sample, *n* = 5,530, *df* = 1**					**Participant sample, *n* = 2,229, *df* = 1**				
	B	SE	Wald	*p*	Odds ratio	*B*	SE	Wald	*p*	Odds ratio
Constant	-1.75	.12	207.78	.000	.173	-3.06	.38	66.42	.000	.05
Age										
≥ 25 (< 25)	.39	.08	23.11	.000	1.48	.67	.13	25.90	.000	1.60
Developmental courses										
Any (None)	-2.32	.18	174.09	.000	.10	-1.57	.20	59.03	.000	.21
Gender										
Male (Female)	-.22	.10	4.54	.033	.81	-.18	.18	1.03	.833	.83
Pell-eligible										
Yes (No)	-.144	.09	2.88	.090	.87	-.07	.14	.30	.583	.93
Race/ethnicity (White)										
Black	-.72	.12	38.07	.000	.49	-.52	.18	8.15	.004	.59
Latino	-25	.25	1.00	.319	.78	-.73	.20	12.93	.000	.48
Other	-.04	.19	.05	.828	.96	-.20	.25	.67	.415	.82
College (CSTCC)										
ARCC	1.45	.18	63.83	.000	4.28	2.91	.44	44.21	.000	18.31
ACTC	1.06	.25	17.98	.000	2.88	.61	.50	1.50	.221	1.84
ECC	-.02	.24	.01	.921	.98	1.63	.36	20.18	.000	5.10
JCTC	1.13	.12	94.51	.000	3.10	1.74	.39	20.32	.000	5.68
OCC	.25	.26	.92	.337	1.29	2.02	.38	27.78	.000	7.57
PTCC	*	*	*	*	*	1.91	.40	22.68	.000	6.76
TXC	-1.75	.12	206.78	.026	.56	1.45	.41	12.58	.000	4.26

Notes.

1. None of the students at PTCC in the comparison sample were awarded an associates within the sample timeframe.
2. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)
3. Comparison Sample: Nagelkerke R^2 = .305, H(8) = 35.23, p = .000; Participant sample: Nagelkerke R^2 = .184, H(8) = 14.78, p = .064

For the next set of logistic regression analyses the sample was limited to only students in each sample who were enrolled in associate's degree programs. This analysis was done first for comparison sample, then for participant sample. In the comparison sample there were 3,271 students who were enrolled in associate's degree programs. This included students who enrolled in multiple programs of study of different lengths, when at least one of programs they were enrolled in was an associate's degree program. Of the 3,271 students enrolled in associate's degree programs, there were 228 (7.0%) students with missing data who were excluded from the analysis. This model was $x^2(14) = 686.47$, $p = .000$, $n = 3{,}403$ (Table 22). The model correctly classified 74% of cases. There were four statistically significant findings for underserved subgroups of students under this model. Nontraditional-age students, students who did not take developmental education courses, and female students had higher odds of earning one or more associate's degrees, 1.77 times, 16.67 times, and 1.41 times higher respectively. White students had 2.04 times higher odds of earning one or more associate's degrees when compared to Black students.

The next logistic regression model sample was limited to students in the participant sample who were enrolled in associate's degree programs. In the participant sample there were 1,713 students who were enrolled in associate's degree programs. This included students who enrolled in multiple programs of study of different lengths, when one or more of these programs were associate's degree programs. Of the 1,713 students enrolled in associate's degree programs, there were 212 (12.4%) students with missing data who were excluded from the analysis. This model was $x^2(14) = 253.360$, $p = .000$ (Table 22). The model correctly classified 80.7% of cases.

Table 22

Logistic Regression Analysis of Students Enrolled in Associate's Degree Programs Being Awarded One or More Associate's Degrees Based on Age, Developmental Education Coursework, Gender, Pell Eligibility, and Race and Ethnicity

Student demographics (comparison)	**Comparison sample, *n* = 3,043, *df* = 1**					**Participant sample, *n* = 1,501, *df* = 1**				
	B	SE	Wald	*p*	Odds ratio	*B*	SE	Wald	*p*	Odds ratio
Constant	-1.47	.17	73.67	.000	.23	-3.49	.46	58.69	.000	.03
Age										
≥ 25 (< 25)	.57	.10	35.86	.000	1.77	.79	.16	25.22	.000	2.20
Developmental courses										
Any (None)	-2.77	.26	116.57	.000	.06	-1.76	.24	53.55	.000	.17
Gender										
Male (Female)	-.34	.12	8.18	.004	.71	-.06	.21	.07	.79	.95
Pell-eligible										
Yes (No)	-.15	.10	2.29	.130	.86	-.04	.16	.07	.78	.96
Race/ethnicity (White)										
Black	-.71	.14	26.23	.000	.49	-.56	.22	6.19	.013	.57
Latino	-.32	.32	1.04	.309	.72	-.51	.23	4.86	.028	.60
Other	.15	.25	.34	.560	1.16	.05	.27	.04	.843	1.05
College (CSTCC)										
ARCC	1.37	.22	37.53	.000	3.93	3.49	.51	46.40	.000	32.7
ACTC	.58	.31	3.49	.062	1.79	1.28	.58	4.98	.026	3.61
ECC	*	*	*	*	*	2.08	.44	22.70	.000	8.01
JCTC	.94	.17	31.73	.000	2.56	2.29	.48	23.03	.000	9.83
OCC	-.106	.34	.10	.757	.89	2.63	.46	32.67	.000	13.89
PTCC	*	*	*	*	*	2.76	.49	31.52	.000	15.79
TXC	-.03	.36	.01	.932	.97	2.19	.55	15.63	.000	8.95

Note.

1. Anoka Ramsey Community College (ARCC), Ashland Community and Technical College (ACTC), Cincinnati State Technical and Community College (CSTCC), El Centro College (ECC), Jefferson Community and Technical College (JCTC), Owens Community College (OCC), Pine Technical and Community College (PTCC), Texarkana College (TXC)
2. Comparison Sample: Nagelkerke R^2 = .296, H(8) = 38.66, p = .000; Participant sample: Nagelkerke R^2 = .248, H(8) = 16.55, p = .035

There were four statistically significant findings for underserved subgroups of students under this model. Nontraditional-age students and students who did not take developmental education courses had higher odds of earning one or more associate's degrees, 2.20 times and 5.88 times higher respectively. White students had higher odds of earning one or more associate's degrees when compared to Black students or Latino students, 1.75 and 1.67 times higher odd respectively.

Summary by Subgroup

The following is a brief overview of the major findings for each of the underserved subgroups included in this study. The purpose of these summaries is to help the reader integrate the findings of this chapter by subgroup and the existing literature while calling attention to key findings in this study.

Latino students. Educational outcomes for students in the participant sample were reflective of what was previously documented in the literature. Specifically, Latino students are underrepresented relative to credentials earned (Graham, 2013; Congleton, 2012). White students in the participant sample had significantly higher odds than Latino students of being awarded one or more credentials or associate's degrees. These findings also reflect what the Bragg et al. (2015), found in their description of credential earning among students who participated in the H2P Consortium's programs of study. Bragg et al., reported that that 27.2% of Latino participants were awarded one or more credentials, as compared to 51% of White participants. The findings for the sample of Latino students in the participant sample had higher odds of receiving an associate's degree than that found by Bragg et al. when examining the full sample of H2P participants.

While there is a higher percentage of Latino students in the participant sample then in the retrospective sample, there is evidence to raise concern about the outcomes of these students. First, a high proportion of Latino students in the participant sample were in an unknown program of study. This could be a reflection of a deficit in the dataset, or could reflect a higher number of students are either delayed or diverted from enrolling in a program of study. It is possible that in conjunction with the lower odds of completing a credential or earning an associate's degree that ultimately the employment prospects of these Latino students may be diminished in comparison to their White counterparts. This concern reflects the fact that among health professions, employment of Latinos is heavily concentrated in low paying entry level occupations, where unlike higher paying occupations in the field Latinos are overrepresented (Baldwin et al., 2006; National Center for Health Workforce Analysis, 2015).

The high retention rates paired with the lower likelihood of achieving other academic outcomes for Latinos may be reflect may reflect a high level of participation in the of this subgroup in the Health Occupations Core Curriculum (HOCC). Across the consortium, 39% of all students who participated in H2P programs of study from 2012 - 2014 were enrolled in one or more HOCC courses (Bragg et al., 2015). The implementation of a HOCC was one of the eight strategies implemented by H2P with TAACCCT funding. However, the distribution of engagement with the HOCC was not even across colleges, in part because ECC had a well-established HOCC prior to receiving TAACCCT funding (Office of Community College Research and Leadership, 2015). In fact at ECC, a full 78% of H2P participants enrolled in one or more HOCC courses. Across the consortium, 64% of Latino students enrolled in HOCC courses; in large part because of the high proportion of Latino students at ECC as compared to

other H2P colleges. At The HOCC coursework is considered pre-program of study coursework at ECC, and students who complete this coursework in the HOCC do not earn a credential (Office of Community College Research and Leadership, 2015). As these HOCC courses are not unique to any program of study, participation in these courses may delay the point at which students both enter a program of study and are able to be assigned to a program of study.

Black students. The enrollment of Black students was not significantly different between the comparison and participant samples. The enrollment of Black students in health professions programs at most H2P colleges met or exceeded what would be expected based on the college population for both the comparison and participant samples. However, enrollment patterns for Black students across different program of study lengths varied between the comparison and participant samples. In the comparison sample, a significantly smaller proportion of Black students enrolled in short-term certificate and associate's degree programs of study. And, a significantly larger proportion of Black students were enrolled in very short-term certificate programs. In the participant sample, a significantly smaller proportion of Black students enrolled in associate's degree programs of study, and a significantly larger proportion enrolled in multiple programs of study of different lengths. While the finding was not significant it is of note that in the participant sample had a smaller proportion of Black students enrolled in very short-term certificate programs of study than was found in the comparison sample.

These findings suggest that Black students in the participant sample may have engaged in the industry-recognized stackable credentials developed and implemented at H2P colleges with the support of TAACCCT funding. The implementation of stackable credentials was one of the eight strategies implemented by H2P colleges with TAACCCT funding, with the intent of using this strategy to accelerate time to completion and streamline pathways to employment for their

students (Office of Community College Research and Leadership, 2015). H2P also saw industry-recognized stackable credentials as an opportunity to reskill and upskill incumbent workers, contributing to their career development and job security (Office of Community College Research and Leadership, 2015). Research supports the assertions that H2P made in regards to stackable credentials suggesting that stackable credentials contribute to student completion, provide students with opportunities gain employment and experience in their field while continuing their education, and improved career mobility and job security (Oates, 2010).

Educational outcomes for Black students in the participant sample were reflective of what is already documented in the literature. Specifically that Black students are underrepresented relative to credential earned (Congleton, 2012; Crowley, 2010; Graham, 2013; National Center for Health Workforce Analysis, 2015; Smedley et al., 2004). The findings also reflect what was reported by Bragg et al. (2015). Bragg et al. reported that 39% of Black participants were awarded one or more credentials, as compared to 51% of White participants. Likewise, Bragg et al. found that Black participants where significantly less likely to being retained at the close of the grant, and significantly less likely to be awarded one or more credentials, long-term certificate, or associate's degree. Bragg et al. found that White participants in H2P were 1.6 times more likely than Black participants in H2P to be awarded one or more associate's degrees. White students in this study had significantly higher odds than Black students of being awarded one or more credentials, certificates, or associate's degrees in both the comparison and participant samples. However, the change in these odds between the comparison and participant sample show that incremental progress was made towards educational equity for Black students.

Male students. The literature on healthcare occupations highlights the disproportion representation of females in nursing, allied health, administrative, and technical occupations

within healthcare (Carnavale et al., 2012; The National Center for Health Workforce Analysis, 2015; Smedley et al., 2004). This disproportionate representation was reflected in the findings of this study. There was significantly less males in the participant sample as compared to the comparison sample. In the participant sample there was 74% of the number of males anticipated based on the proportion of males in the comparison sample. In the comparison sample there were significantly less males who enrolled in long-term certificate programs and who were categorized as program of study unknown. This finding aligns with Dadgar and Weiss (2012) finding that long-term certificate earners in nursing and allied health are disproportionately female. However, in the participant sample the enrollment patterns by program of study length by program of study length were not significantly different between males and females. The reduction in enrollment among males likely reflects that fact that although males are known to be highly underrepresented in health professions, they were not a target population for the Department of Labor priorities for TAACCCT or any of the H2P strategies. While colleges strived to meet and exceed participation goals for the grant, there was no incentive to colleges to attract male students despite the well documented need for male health professionals.

There were differences in the educational outcomes for males in both the comparison and participant samples. With the exception of being awarded an associate's degree, a larger percentage of both male and female students in the participant sample met each of the educational outcomes included in the study. For both samples and in nearly every case, a larger percentage of females than males reached the educational outcomes included in this study. The one exception was that 26% of females and 27% of males in the participant sample were retained without being awarded a credential. These findings are similar to what was noted by Bragg et al., (2015) who found that a higher percentage of female H2P participants were awarded credentials.

The findings in this study for the comparison sample supported the previous research that overall women in career and technical education programs are more likely to persist and earn an associate's degree (Compton, et al., 2010; Maguire et al., 2012). However, in the participant sample the odds of males and females achieving any of the educational outcomes included in this study were not significantly different.

Pell-eligible Students. There were significantly more students who were Pell-eligible in the participant sample than in the comparison sample. Students who were Pell-eligible accounted for 46% of the comparison sample and 52% of the participant sample. The percentage of students who were Pell-eligible in the comparison sample ranged from 19% to 70% across the H2P colleges. At six of the colleges the percentage of students who were Pell-eligible rose, including TXC where the percentage of students who were Pell-eligible doubled from the comparison to the participant sample.

The enrollment patterns by different program of study lengths for Pell-eligible students varied between the comparison and participant samples. In both samples a significantly smaller proportion of Pell-eligible students enrolled in a short-term certificate programs of study. This likely reflects the limitation of the Pell eligibility study. A substantial portion of students in very short-term certificate programs of study and short-term certificate programs including those in the colleges' certificated nursing assistants may not have enough credits to qualify for Pell funding and are far less likely to complete their FAFSA. As such, while these students in these programs are predominately low-income, they are likely not receiving the support of a Pell grant.

In the comparison sample a significantly smaller proportion of Pell-eligible students enrolled associate's degree programs of study; however; in the participant sample a significantly larger proportion of Pell-eligible students enrolled in associate's degree programs of study. A

significantly larger proportion of Pell-eligible students in the comparison sample were enrolled in long-term certificate programs of study. Where in the participant sample a significantly larger proportion of Pell-eligible students were enrolled in multiple programs of study of different lengths.

The proportion of Pell-eligible students reaching each educational outcome was different between the two samples. In the comparison sample, a higher percentage of students who were not Pell-eligible as compared to those who were Pell-eligible reached all four of the educational outcomes in the study. In the comparison sample student who were not eligible for Pell had significantly higher odds of being awarded one or more credentials. However, in the participant sample, a higher percentage of students who are Pell-eligible as compared to those who were not Pell-eligible reached each of the educational outcomes in the study with the exception of awarded one or more associate's degrees. Additionally, when comparing the two samples, there was a higher percentage of Pell-eligible students in the participant sample who were retained without being awarded a credentials, awarded one or more certificates, and awarded one or more credentials. In the participant sample students who were eligible for Pell had significantly higher odds of being retained without a credential. These findings reflect the importance of Pell grant funding in supporting low-income students in reaching positive educational outcomes, especially in degree programs that span multiple years of study.

Nontraditional-aged students. There were significantly more nontraditional-aged students in the participant sample than in the comparison sample. Nontraditional students who were 25 years of age or older accounted for 52% of the comparison sample and 57% of the participant sample. A significantly larger proportion of nontraditional-aged student in the comparison sample enrolled in long-term certificate programs. Where, a significantly larger

proportion of nontraditional-aged student in the participant sample enrolled in associate's degree programs. And, a significantly smaller proportion of nontraditional-aged student in the participant sample enrolled in very short-term certificate programs of study. Nontraditional-aged students in both samples, as compared to traditional-aged students who were under 25 years of age, had higher odds of reaching several of the educational outcomes examined in this study. Specifically, nontraditional-aged students had significantly higher odds of being awarded one or more certificates, credentials, and associate's degrees.

While nontraditional-aged students in both samples had high odds of completing reaching most of the studies educational outcomes, the data shows a shift from certificate programs to associate programs for nontraditional-aged students between the retrospective and participant samples. This shift may be reflect in part the engagement of nontraditional-aged students in new, enhanced, and expanded TAACCCT-funded incumbent health professions programs. One of H2P's eight strategies was to develop "training programs for incumbent health workers" (Cincinnati State Technical and Community College, 2011, p. 13). Five of the H2P colleges, developed new or enhanced existing incumbent professional health care programs of study as part of their TAACCCT-funded activities (Bragg et al., 2015). While these programs included very short-term certificate programs, short-term certificate programs, and associate's degree programs, ECC and JCTC – two of the larger H2P colleges implemented and enhanced sizable associate degree programs (Bragg et al., 2015). Additionally, the nontraditional-aged students in this study may have previously earned degree or other credentials and be returning to reskill or train for a second career (Levesque et al., 2000)

Developmental education students. There was significantly fewer students who completed one or more developmental education courses in the participant sample as compared

to the comparison sample. The first priority of the Department of Labor was to accelerate progress for low skilled and other workers by building programming that efficiently and effectively helped students to gain the foundational skills necessary to enter, be retained in, and complete a program of study. Under this priority grantees were encouraged to build programming that efficiently and effectively helped students to gain the foundational skills necessary to enter, be retained in, and complete a program of study. This reduction in the number of participants who took developmental education courses could reflect efforts that were made by H2P colleges to reduce students need for developmental education. This involves a wide range of personalized interventions that were incorporated in H2P colleges enhanced retention services. These supports included pre-assessments, tutoring, and intensive training session—aka bootcamps; that reduced students' needs for developmental education coursework (M. Krismer, personal communication, April 20, 2009; Office of Community College Research and Leadership, 2015). These interventions likely also supported the improved academic outcomes for students who completed one or developmental education courses, in addition to benefiting from these targeted retention services.

Students who completed one or more developmental education courses accounted for 34% of the comparison sample and 31% of the participant sample. Students who completed one or more developmental education courses in the participant sample had significantly lower odds of reaching most of the educational outcomes included in this study, when compared to students who did not take developmental education courses. However, in most cases the odds of students who took developmental education courses were notably higher for students in the participant sample as compared to the comparison sample. Students who completed one or more developmental education courses had significantly higher odds of being retained without a

credential in both the comparison and participant samples, 1.81 and 1.98 times higher odds respectively. Students who did not take developmental education courses in the comparison sample had 1.30 times higher odds of being awarded one or more certificates. However, there was no significant difference in the odds of being awarded one or more certificates for students who did or did not take developmental education courses in the participant sample. The odds of being awarded one or more credentials also favored students who did not take developmental education courses with their odds at 3.45 times higher in the comparison sample and 2.31 times higher in the participant sample.

The biggest differences between the comparison sample and the participant sample for students who completed developmental education courses was found in the odds of students being awarded an associate's degree. These findings are consistent with what is reported in the literature, with students who completed developmental education being significantly less likely to have completed an associate's degree (Attewell, 2006). The odds of being awarded one or more associate's degrees favored students who did not take developmental education courses with their odds at 10.0 times higher in the comparison sample and 4.76 times higher in the participant sample. The difference is even more dramatic when the sample is limited to only the students who were enrolled in associate's degree programs. With this restricted sample, the odds of being awarded one or more associate's degrees favored students who did not take developmental education courses with their odds at 16.67 times higher in the comparison sample and 5.88 times higher in the participant sample.

There were three strategies that are likely contributed to the improved academic outcomes for students who completed developmental education. The first is the personalized interventions discussed earlier as part of the retention services. Secondly, the H2P colleges

integrated developmental education into health professions coursework. Most notably the colleges integrated developmental education into the health occupations core curriculum (HOCC). These HOCC courses were not considered to be developmental education courses, however, participation in these courses provided students with educational supports and demonstrated the relevance of these skills to successfully completing a health professions program and in caring for patients in the health occupations. Additionally, students who participated in HOCC and developmental education courses, may have accelerated their progress through developmental education coursework, resulting in improved retention and completion for these students.

Summary

This chapter provided an overview of the development of the dataset and a description of the populations and sample demographics. This was followed by the findings from a series of Equity Indexes, chi-square analyses, and logistic regressions analyses that compare the enrollment of subgroups of students in the comparison and participant samples. The analysis presented addresses this study's research question, were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges? The Equity Indexes allowed for an analysis that compares proportion of students in three of the underserved subgroups that in each sample as compared to the H2P colleges, as well as compare the proportion of these subgroups of students across the two samples. The chi-square analyses served to compare the expected and observed proportions of students enrolled in health professions programs of study in the participant sample as compared to the comparison sample. Chi-square analyses were used to compare the enrollment

patterns by program of study length for subgroups of students in each sample. The logistic regression analyses compared the educational outcomes for subgroups of students in each sample.

Conclusion

This chapter starts with a brief overview of the study including research question, data sources, and setting for the study. Second, the evidence that inequities existed for underserved students in health profession programs of study at H2P colleges prior to the TAACCCT investment is summarized. Third, key findings on the changes in educational equity for underserved subgroups is discussed. The fourth, fifth, and sixth sections discuss the implications for theory, policy, and practice. In the seventh section, potential areas for future research based on the findings of this study are summarized. Finally, the limitations of the completed study are shared.

Overview of the Study

This study examined one federal human capital investment in health professions education for evidence of a changes in educational equity for underserved student subgroups. Specifically, this study compared enrollment and educational outcomes of underserved student subgroups enrolled in health professions programs of study in a consortium of nine community colleges, before and after the consortium received a $19.6 million TAACCCT grant. This was done by comparing the characteristics of a sample of students enrolled at H2P colleges prior to receiving TAACCCT funding with a sample of students who enrolled at H2P colleges in TAACCCT-funded programs of study. The first sample, referred to as the comparison sample, consisted of 8,673 students who enrolled in health professions programs of study in 2008 or 2009 at H2P colleges. The second sample, referred to as the participant sample, consisted of 4,693 students who enrolled in TAACCCT-funded programs of study in 2012. Both samples were drawn from eight of the nine H2P colleges. The ninth college was excluded from the study

because a comparison sample was not available. The study compared the demographics of students in the two samples, as well as their retention and program completion over a three year period (2008 - 2010, 2009 - 2011, and 2012 - 2014). Underserved populations in health professions programs of study examined in this study are a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. This study addressed the following research question:

> Were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges?
>
> a. What changes were there in the proportion of underserved students who enrolled in health professions programs of study prior to and after receiving TAACCCT funding?
> b. What changes were there in the educational outcomes of underserved subgroups of students enrolled in health professions programs of study prior to and after receiving TAACCCT funding?

This study utilized two sources of secondary data. The first data source utilized in this study are data gathered by the OCCRL for their third party evaluation of H2P. The OCCRL data included a database of student record data that included student demographics, course history, and credentials awarded by the college. Most of the data required for this study were part of this student record database. OCCRL also collected data on the health professions programs of study at each H2P college, including those not impacted by TAACCCT funding. This program data was used in assigning program length. The second data source utilized in this study were disaggregated enrollment data reported by H2P colleges in their *IPEDS 12-Month Enrollment*

reports. IPEDS data were used in the analysis of enrollment at H2P colleges using Bensimon et al.'s (2003) Equity Index and chi-square analysis, for the following subgroups: a) Latino students, b) Black students, and c) male students.

There were three stages of data analysis in this study. The first stage was an examination of the enrollment of the two samples in comparison to the populations served at each H2P college. Bensimon et al's (2003) Equity Indexes were used to calculate the proportion of Latino students, Black students, and male students in each sample as compared to the college-wide enrollment and consortium wide enrollment. The second stage of analysis used both Equity Indexes and goodness-of-fit chi-square analyses to compare the composition of the two samples. In this stage Equity Indexes were used to compare the proportion of the Latino students, Black students, and male students in the two samples. Chi-square analyses were used to compare the composition of students in each of the subgroups featured in this study including: a) Latino students, b) Black students, c) students who were eligible for Pell grants, d) male students, e) students who were 25 years of age or older, and f) students who completed developmental education coursework. In the final stage of analysis the likelihood of students in each underserved subgroup being retained or completing their program of study was calculated using logistic regression analyses. The outcomes examined for each of the subgroups in the study were a) retained without a credential, b) awarded one or more certificates, c) awarded one or more associate's degrees, and d) awarded one or more credentials. A logistic regression analysis was run for each sample and for each outcome, showing the relative likelihood of each subgroup reaching the outcome. This analysis was done at the consortium level using a fixed effect technique to account for variation among the H2P colleges.

Inequities Among Students in the Comparison Sample

The concept of educational equity is central to this study. Recall that Levin (1994) provided the following simple criteria for measuring educational equity. "A reasonable criterion is that we have obtained educational equity when representatives of different racial, gender, and socioeconomic origins have about the same probabilities of reaching different educational outcomes (pp. 168)." In light of that definition, the relevance of this study is situated in the existence of educational inequities that can be identified by significant relationships between students' characteristics such as race, gender, and socioeconomic origin and their educational outcomes. This study extends back to include enrollment as the first milestone or educational outcome for students and extends through their retention in or completion of one or more programs of study. This reflects the argument that access to and participation in postsecondary education is a critical factor in understanding educational equity (Bensimon, 2004).

An examination of the findings specific to the comparison sample demonstrates that there were educational inequities for underserved populations at H2P colleges that existed prior to the consortium receiving TAACCCT funding. The Equity Indexes provide evidence that there were inequities in enrollment among subgroups of Latino students, and male students at H2P colleges in the comparison sample as compared to the college-wide populations. These Equity Indexes showed a substantially lower proportion of both Latino students (38%) and male students (45%) in the comparison sample than would be expected based on the proportion of these students at H2P colleges. However, the proportion of Black students in the comparison sample was higher than anticipated at 119% of what would be expected based on the proportion of Black students at H2P colleges. In all three cases there is notable variation among the H2P colleges with the

proportion of Latino students ranging from 0% to 269% of what would be expected, Black students ranging from 0% to 151% of what would be expected, and male students ranging from 15% to 122% of what would be expected. ECC's high representation of males at 122% of what was expected, was a deviation from the trend among colleges in the comparison sample with all other colleges having 75% or less of the number of students expected.

The variation in enrollment patterns of subgroups of students in programs of study of different lengths provide further evidence of educational inequities. Here the evidence was mixed. There were significant differences in the patterns of different subgroups' enrollment in programs of study by length. For example, a significantly larger number of Black students in the comparison sample enrolled in very short-term certificate programs; however, a significantly smaller proportion of Black students in the comparison sample enrolled in short-term certificates. While not significant, a smaller proportion of Latino students in the comparison sample were enrolled in very short-term certificates and short-term certificates. These findings are in contrast to the overrepresentation of Black and Latino health professionals in low-paying entry-level health support occupations highlighted by The National Center for Health Workforce Analysis (2015). The inequities are clearer in enrollment differences at the associate's degree level. Just over half of students (51%) in the comparison sample enrolled in an associate's degree program of study. There was a smaller proportion of students who enrolled in an associate's degree programs in each underserved subgroups included in the study. In the cases of Black students, Pell-eligible students, and students who completed developmental education, this difference was statistically significant.

The variation in the likelihood that subgroups of students in the comparison sample would reach the educational outcomes included in this study provide the additional evidence of educational inequities that existed prior to the H2P Consortium receiving TAACCCT funds. Nontraditional-aged students had higher odds of reaching each of the educational outcomes examined, with significantly higher odds of being awarded one or more credentials or associate's degrees. This may indicate that educational equity was not an issue for the nontraditional-aged students who were enrolled in health professions programs of study at H2P, before the colleges received TAACCCT funding. Alternatively, this difference may reflect different KSAs that would be expected between traditional and nontraditional-aged students.

With the exception of earning one or more certificates, the likelihood of Black students in the comparison sample achieving the educational outcomes included in this study were significantly lower than that of White students. The odds of Latino students' in the comparison reaching the educational outcomes included in this study were lower than that of White students, although not significantly so. Male students in the comparison sample were significantly less likely to be retained without a credential and significantly less likely to earn an associate's degree then female students. However, males were significantly more likely than females to be awarded one or more certificates.

Students in the comparison sample who completed developmental education courses had a much higher likelihood of being retained without a credential than students with no record of developmental education. However, they had a significantly lower likelihood of being awarded one or more certificates, credentials, or associate's degrees. With the most notable disparity at the associate's degree level. Students with no record of developmental education courses were 10 times more likely to be awarded an associate's degree, than students who completed one or more

developmental education courses. As discussed above, lower odds are anticipated for this subgroup, reflecting a difference in students KSAs at the time of entering and the addition of developmental education coursework to the students' course loads.

Changes in Educational Equity for TAACCCT Participants

Having reviewed the evidence of educational inequities that existed prior to H2P colleges receiving TAACCCT funding, the question remains, were there changes in educational equity for underserved subgroups of students who participated in TAACCCT-funded health professions programs of study at H2P colleges? To answer this question, both changes in enrollment and educational outcomes need to be considered in order to fairly address the research question.

Changes in equity relative to enrollment. Based on Bragg et al. (2015), it was anticipated that the composition of the comparison and participant samples would be significantly different, and that there would be higher rates of retention and completion for H2P student in the participant sample as compared with students in the comparison sample. The participant sample and comparison sample, called the retrospective sample used in the Bragg et al. study was the full sample frame used in this study. The distribution of demographic characteristics between the comparison sample and participant sample in the Bragg et al.'s impact analysis were notably different. Bragg et al. found that the participant sample, in their study, had higher proportion of male students, Black students, nontraditional-aged students, and Pell-eligible students than they found in their comparison sample. The findings of this study confirm that there were significant differences in the composition of the demographic characteristics of the comparison sample and the participant sample. In this study there were significantly higher proportion of students in the participant sample, as compared to the comparison sample, who were nontraditional-aged, Pell-eligible, or Latino students. There was a

significantly lower proportion of students in the participant sample, as compared to the comparison sample, who had completed developmental education courses and who were male.

Impact of H2P on educational outcomes. Bragg et al. (2015) found that there was "compelling evidence that the reforms that H2P colleges implemented made a positive impact on the attainment rates of healthcare students" (p. v). As of the end of the December 31, 2014, 2,021 of the H2P participants had earned one or more credentials, and 65% of the participants had earned at least one credential or were retained at the college (Bragg et al., 2015). This percentage of students who either earned a credential or were retained varied among the demographic subgroups of students served by H2P ranging from 50% to 74% (Bragg et al., 2015). With Black students, students who completed developmental education, and male students having had significantly lower odds of being awarded one or more credentials as compared to their peers (Bragg et al., 2015). In an analysis comparing H2P participants enrolled in LVN and ADN programs of study with students from the comparison sample, Bragg et al. found that H2P participants had a 1.6 times higher odds of completing their programs than students in the comparison sample.

The findings of this study indicate that there were notable differences between the educational outcomes of students that were in health professions programs of study before the colleges received TAACCCT funding and the educational outcomes of students who were in TAACCCT-funded health professions programs of study. Of the students in the comparison sample, 54% were retained, or had earned one or more credentials in a three year period timeframe. Whereas, 66% of the participant sample were retained, or had earned one or more credentials in a three-year period timeframe. In fact, there were a large number of cases where the percentage of a student subgroup who reached the educational outcomes included was higher

in the participant sample than in the comparison sample. This included not just the underserved subgroups of students that are the focus of this study, but all subgroups of students included in the study. There were higher percentages of students who were a) traditional-aged, b) nontraditional-aged, c) male, d) female, e) Pell-eligible, f) not eligible for Pell, and g) without a record of developmental education coursework in the participant sample, as compared to the comparison sample, who were a) retained without earning a credential, b) awarded one or more certificates, and c) awarded one or more credentials. Higher proportions of Black students, White students, and students categorized as other race in the participant sample, as compared to the comparison sample, were awarded one or more certificates, credentials, or associate's degrees. There was a higher proportion of students who completed developmental education coursework that were awarded one or more certificates, credentials, and associate's degrees in the participant sample than in the comparison sample.

Students in the comparison sample has significantly higher odds, 1.90 times higher, of being retained without having been awarded a credential at the end of the sample timeframe. However, students in the participant sample had significantly higher odds, than that of students in the comparison sample, of earning one or more certificates (4.56 times higher odds), credentials (3.12 times higher odds), or associate's degrees (1.28 times higher odds). This indicates that the odds of reaching these educational outcomes were higher for students in TAACCCT-funded programs of study. However, in order for there to be changes in educational equity, changes in educational outcomes need to include a reduction in disparities that exist between the odds of achieving the educational outcomes for underserved subgroups of students and that of other more privileged subgroups of students.

Changes in equity relative to educational outcomes. The largest change in odds for underserved student populations were in their odds of being retained without a credential, with the exception of nontraditional-aged students. There were small positive changes in the odds of being awarded an associate's degree for all of the underserved student populations, with the exception of Latino students. However, the changes in odds of being awarded an associate's degree for Black students, Pell-eligible students, and male students were very small, 0.10, 0.02, and 0.06 respectively. Latino students' odds of being retained without a credential were substantially higher for the participant sample (0.79 higher) and were higher for being awarded one or more certificates (0.15 higher). However, the odds of Latino students in the participant sample being awarded a credential or of being awarded an associate's degree were lower, 0.20 and 0.30 lower respectively. While Black students in the participant sample had higher odds of being retained without a credential (0.32 higher), their odds of being awarded a certificate were far lower (0.45 lower). Students in the participant sample who completed developmental education had higher odds of reaching each of the studies educational outcomes, although the difference in odds for being awarded one or more certificates was only 0.03. Nontraditional-aged students had a decrease in the odds of being a) retained without earning a credential, b) awarded one or more certificates, and c) awarded one or more credentials; and an increase in odds of earning one or more associate's degrees. In the participants sample, nontraditional-aged students odds of being awarded one or more credentials were nearly equivalent to that of traditional-aged students, and their odds of being awarded one or more associate's degrees was 1.60 times higher than traditional-aged students.

Implications for Theory

HCT investments have demonstrated positive returns across student populations (Becker, 1993; Levin, 2008; Sweetland, 1996). The findings of this study compliment the findings of Bragg et al. (2015) in providing solid evidence that demonstrate that the TAACCCT human capital investment in H2P resulted in changes in enrollment and improved the odds of participants earning a credential. Overall, HCT suggests that there is a wide range of benefits at an individual, organizational, and societal levels that have are associated with human capital investments, including investments in education (Sweetland, 1996).

HCT and educational equity. Unlike much of the current research on HCT, this study is not about the economic benefits for student populations related to human capital investments. Instead this study examines the assertions that human capital investments are a tool that can be used to improve equity (Becker, 1993; Levin 2008). To support this theory economists argue that the federal government has strong economic interest in building a more diverse and equitable workforce (Levin, 2008; Levin, Belfield, Muenning, & Rouse, 2007). Part of the benefits of improved equity are higher future gains from future human capital investments. Becker (1971) demonstrated that a more equitable society will see greater overall returns from investments in human capital (Becker, 1971; Levin, 2008). Specifically, HCT theorists argue that investments in underserved populations who are educationally disadvantaged due to circumstances of birth and discrimination have the highest potential for economic and social returns (Becker, 1971; Levin, 2008). This argument is used to suggest that human capital investments in education will have a disproportionate impact in favor of underserved populations, resulting in changes in equity (Levin, 2008). Educational investments that promote successful educational outcomes for educationally disadvantaged student populations have the highest potential for returns that

benefit not just the individuals or the subgroups of effected students, but to the benefit of society as a whole (Becker, 1964; Heckman & Krueger, 2003; Levin, 2008, Levin et al., 2007).

The Department of Labor made a $19.6 million human capital investment in the H2P Consortium. This human capital investment provides an excellent opportunity to examine changes in educational equity, in an industry where there are high stakes in improving equity. HCT theory would suggest that there would be improvement to educational equity as a result of a substantial human capital investment in education such as TAACCCT. This study clearly demonstrates that there were changes in enrollment and educational outcomes for underserved subgroups of students. While often these changes were to the benefit of underserved populations, this was not consistently the case. Male students, for example, not only represented a smaller proportion of the participant sample, their odds of being awarded a credential was notably lower. In contrast, while there were significantly fewer students in the participant sample who completed developmental education courses, their odds of reaching every educational outcome included in the study rose, in most cases significantly.

Signaling theory would suggest that if underserved populations engage in and complete college at similar rates as their peers, they will not have the credentials necessary to signal their value to potential employers (Spence, 1973; Rosenberg, 1992). As such, it is reasonable to assert that in order for the federal government to impact equity, underserved students populations' odds of earning credentials need to improve at rates at least comparable to students in traditionally served populations who are also benefiting from the investment. In many cases, the findings in this study would support that the federal TAACCCT investment did indeed benefit some underserved subgroups at rates that compared to or outpaced their peers. However, not every subgroup of students were engaged equally or benefited equally, overall Pell-eligible students,

nontraditional-aged students, and students who completed developmental education coursework had better odds as participants in H2P's TAACCCT-funded programs. However, outcomes for male students, Black students, and Latino students' outcomes were mixed with some indication that these populations did not see the benefits that their peers gained from the TAACCCT human capital investment.

The findings in this study regarding educational equity are not consistent across subgroups. This inconsistency supports the arguments by critical theories that HCT fails to adequately account for the role of hereditary, cultural naturalization, and social class (Bowles & Gintis, 2002; Meyer, 1977). Specifically, the differing effects of the human capital investment reflect systematic inequities and discrimination that impact underserved students populations both in and outside of the educational environments. If the cumulative weight of these disparities substantially reduces the impact of the human capital investment, as suggested by Becker (1993), then human capital investments have the potential to support the status quo or even contribute to inequality.

This warrants a new assertion to extend the current argument in support of the use of human capital investments to impact equity. Specifically, the federal government must acknowledge existing systematic inequities, and ensure that human capital investments reach and have the intended impact for underserved and underrepresented populations. In terms of federal investments in human capital, this acknowledgement means targeted investments that support underserved populations. This assertion is supported by the strongest finding in favor of increased educational equity in this study. The first priority of the Department of Labor was to accelerate progress for low skilled and other workers by building programming that efficiently and effectively helped students gain the foundational skills necessary to enter, be retained in, and

complete a program of study. The gains in odds seen by students who completed developmental education may support the argument that human capital investments in education will have a disproportionate impact in favor of underserved populations, when funding is intentionally targeted to serve underserved populations.

Implications for Policy

HCT theorists argue that there is a moral and economic imperative that supports the federal investment in human capital, including educational grants. These investments are argued to be a critical tool towards building a more equitable workforce and society (Levin, 2008). TAACCCT is a prime example of this type of human capital investment, made to support programs of study at community college, which are known to serve disproportionate populations of underserved students as compared to public four-year institutions. TAACCCT was designed to target low-skilled and displaced workers, who arguably are often members of the subgroups of students included in this study. However, the findings of this study indicate that the benefits of federal grants may not be equitable across different student subgroups, and in some cases may favor more inequitable outcomes.

This study provides insight to the variation in the outcomes of subgroups of students in one consortium of nine colleges where a $19.6 million federal human capital investment was made. However, the investment in H2P was just a small fraction of the $2 billion investment that the Department of Labor made across 256 grants that impacted over 800 educational institutions across all 50 states (U.S. Department of Labor, n.d.-b; Martin, 2015). Despite the scale of this investment the Department of Labor did not collected student record data or require colleges to provide disaggregated outcomes measures that could be used to determine if the impact of this

funding contributed to educational equity. Most of the TAACCCT grants were externally evaluated, as H2P was. However, the primary focus of most of these evaluations was on the overall impact and sustainability of the strategies and programs of study implemented with grant funding. These evaluations shed light on the value in human capital investments, but likely provide only limited insight into the impact of these grants on educational equity.

If as Levin (2008) posited, the federal government does have an interest in promoting an equitable workforce and society through federal grants, this study highlights the importance including an examination of the change in educational equity of the impact as part of its overall examination of the impact of federal human capital investments. This can be accomplished by requiring colleges to report disaggregated outcomes for students' subgroups, provide data on a comparison group, and to provide reference data for the college or region served. If as Becker (1971) posited, the impact of federal human capital investments is hindered when systemic discrimination impacts the outcomes of recipients of the investment, then the federal government should consider means of supporting more equitable pathways for students as a key aspect of maximizing its human capital investments. There are a number of approaches the government may support to this end. For example, federal grants could either focus on or include elements designed to build the capacity of individual educational institutions to build more equitable pathways. Alternatively, the federal government could invest higher levels of resources in innovations that are designed specifically to counter the disparities that impact underserved populations. Federal grants can identify specific target populations in the solicitation in for grant proposals. Alternatively, the solicitation for grant proposals can require institutions in their proposals to identify and justify a target populations that are underserved locally, in the field or

even in their institution. Regardless of the selection of the populations, grantees must be required to report both enrollment and educational outcomes for the target populations.

At minimum the recipients of any federal education grants should be required to collect and report the disaggregated participation and outcomes of students impacted by federal funds. Colleges should be encouraged and supporting in using this information to improve outcomes for underserved student populations. Just as importantly, this disaggregated information should be used at the federal level to examine the impact of funding on educational equity. This information should strongly inform future investments and priorities and any federal funding found to support the status quo or in detriment to education equity should be examined closely and either adjusted to correct the circumstance or discontinued.

Implications for Practice

There are substantial lessons yet to be learned from the work of the H2P Consortium and other TAACCCT recipients that utilized this federal human capital investments to build capacity by reforming educational practice and programs of study across the nation. Because of the substantial TAACCCT investment in health professions and the urgency to improve diversity among health professionals, TAACCCT presents an unpresented opportunity to provide a wide array of evidence as to the impact of federal funding on building equitable representation of underserved individuals among the health professions. The evaluation report on the implementation of H2P outlines a wide array of activities undertaken by the consortium in an effort to expand the populations engaged in their programs and to support these populations through completion of one or more credentials (Office of Community College Research and Leadership, 2015). These strategies included developing partnerships with industry, workforce,

and community-based organizations; working collaboratively towards a goal of training and employing a highly qualified, high skilled, and diverse health professionals (Office of Community College Research and Leadership, 2015). This study compliments the evaluation conducted by the Office of Community College Research and Leadership by highlighting the variation in who benefited from participation H2P, as well as demonstrating were work is needed to engage and support subgroups of underserved students in order to effect the educational equity necessary to build a diverse healthcare profession (Bragg et al., 2015; Office of Community College Research and Leadership, 2015).

Educators working to build educational equity in their programs of study should note the variation in the impact of participating in H2P for different subgroups of students and across H2P colleges. This study does not make distinctions between variation caused by different contexts, differing implementation of strategies, differing needs between subgroups, and other differences within and between the students populations included in this study. However, this variation would suggest that students across different subgroups did not receive the same benefit from the strategies employed by H2P colleges, and that in some cases the benefits to underserved students were not equal to or greater than those of their more privileged peers. This fact alone, suggests that educators who want to improve educational equity by identifying and addressing structural inequities in their programs, or by integrating strategic innovations that support underserved populations, need to monitor the disaggregated enrollment and educational outcomes for their students in order to identify and address equity gaps and to evaluate their efforts to build equity for underserved students.

Areas for Future Research

This study provides insight on the changes in educational equity within health professions programs of study across one consortium of community colleges. The findings of this study suggest that there are several areas where further research could provide useful evidence that could be applied by educators interested in promoting educational equity for underserved populations and building a more diverse health profession workforce. Three of these potential areas for future research include examining a) the relationship between changes in educational equity and employment outcomes, b) the nature of the changes in outcomes for students who completed developmental education coursework, and c) the nature of the disparities in educational outcomes minoritized students.

The relationship between educational equity and employment outcomes. One of the key assumptions in this study is that there is a link between educational equity and a more diverse equitable workforce. Specifically, in this case that reflects an assumption that if a more diverse population is engaged in health professions education and supported through completion of their programs, that resulting graduates will diversify the health professions workforce. An examination of the disaggregated employment outcomes of health professions students would have the potential to reveal the nature of the relationship between educational equity and diversity in the workforce. This is a critical link if researchers want to effect societal change. In the field of healthcare, exploring this relationship would illustrate not only if underserved graduates of healthcare programs compare to their peers in educational prospects, but could also be designed to illustrate the depth of employers' commitment to build diversity at their institutions. Establishing a link to employment and establishing the depth of employers' commitment to diversity in healthcare could be highly influential in colleges' efforts to both

support reforming health professions programs of study and their efforts to engage underserved populations.

Outcomes for students who completed developmental education coursework. Some of the most notable changes in this study were in the outcomes for students who completed developmental education courses. Further examination would provide insight into the nature of this change, especially in light of the fact that there were significantly fewer students who completed one or more developmental education courses. This reduction in the proportion of students in developmental education could be an indication of several possible things including: differences in the populations served and their developmental education needs, changes in the program requirements, changes in the program options available to students, changes in the developmental education coursework offered, or students participation in education as part of the health occupations core curriculum that included contextualized developmental education supports for students. Understanding the nature of the change in participation and the educational outcomes for this group may be enlightening for institutions that want to create better pathways for students who participate in development education with their health professions programs of study.

Examining the disparities in educational outcomes for minoritized students. While both Black students and Latino students in the participant sample had a higher likelihood of being retained than the comparison sample, their odds of completing credential were nominally smaller. In several cases, the odds of being awarded one or more credentials, certificates, or associate's degrees were lower for underserved subgroups in the participant sample than in the comparison sample. These findings deserve further examination. Specifically, it is important to understand both the full scope of these disparities and what these disparities reflect. There are a

number of unanswered critical questions that could provide information on the validity of these findings. Did these populations change in other ways that masked the impact of the human capital investment in them? Do the higher retention rates indicate that there were other factors that delayed completion for these students? What systemic, environmental, and climate barriers did these students face in these programs that impacted their ability to reach the educational outcomes of the study? The answer to these questions could potentially identify contributing factors that need to be addressed by programs to support educational achievement among students of color.

Examining the impact of federal human capital investments on educational equity. Further study that examines how federal human capital investments impact educational equity is necessary. This includes looking at different grant programs, additional industries, and the use of alternative methodologies. In regards to other methodological approaches, mixed methods inquiries could provide insight both into the scope of impact in educational equity and identify the policies, practices, and processes that when funded, result in improved outcomes for underserved populations. Additionally, a more in-depth quantitative examination that focuses on specific underserved populations is needed. This level of investigation could account for interaction terms, and could better account for intersecting identities. Importantly, research that compared subgroup outcomes for statistically significant change would provide further insight into the scope of change possible and when the change may not be reflective of the human capital investment. It would also be a substantial improvement to be able to track the impacts post federal investments, especially when the intent of the investment is a change in capacity as it was with the TAACCCT funding.

Limitations

There are several limitations to this study that are important to acknowledge and address in future studies. The most notable limitations were related to the variation between the proportions of the each underserved subgroup in both samples that came from each college. The most notable variation was with the subgroup of Latino students. Latino students accounted for 2% of the comparison sample and 17% of the participant sample. ECC accounted for 23% of the Latino students in the comparison sample, and 91% of the Latino students in the participant sample. At ECC, 16% of the comparison sample were Latino students, wherein 35% of ECC's participant sample were Latino. The proportion of Latino students in ECC's comparison sample is 56% of what would be expected based on the college-wide population of Latino students at ECC. While the proportion of Latinos in the participant sample at ECC was 224% would be expected based on the comparison sample at ECC, the proportion of Latino students in ECC's participant sample was nearly equivalent at 101% of what would be expected based on the college-wide population of Latino students at ECC. This presents two possibilities. One is that the sampling of the comparison sample at ECC unintentionally favored non-Latino students or that there was a notable growth in the representation of Latino students in health professions programs at ECC between 2008 - 2009 and 2012. With 91% of Latinos in the participant sample at ECC, the number of Latinos in the sample from other H2P colleges was relatively small ranging from 1 and 13 students in total. For this reason, the findings in this study related to Latino students in the participant sample may be related to the H2P TAACCCT grant; however, these findings were more reflective of Latino student enrollment and outcomes at ECC, then they were reflective of the H2P Consortium.

The second limitation was the inability of the study to fully situate the educational equity in the context of the different colleges in the consortium. The Equity Indexes provided some insight into the relationship between the proportion of male students, Black students, and Latino students in the sample as compared to college-wide at the H2P colleges. However, there was not a similar comparison made for the other subgroups. Further, none of these comparisons provided information about the proportion of these different subgroups among the adult population in the colleges' service areas. Instead the study relied on the assumption that college-wide enrollment of students was reflective of the communities served by the college, an assumption that was most assuredly flawed.

The third limitation was the use of a participant sample who enrolled in the first year after the H2P Consortium received TAACCCT funding. The sample and sample timeframe were selected to provide students with the time necessary to complete their programs and reach the educational outcomes in the study. The result was that that participant sample consisted of students engaged by the consortium in the first year of a four year grant. While this represented the largest year in terms of enrollment for the H2P Consortium, many of the strategies, new programs of study, and enhancements to existing programs of study were not fully implemented when these students enrolled in their programs of study. As such, the results in this study may not be consistent with the impact of the fully implemented scope of work for H2P under the TAACCCT grant.

The last limitation that impacted the study was that the study did not control for students' KSAs, and as such, it was impossible to know how much of the change in odds for underserved subgroups of students reflects differing abilities between the comparison sample and participants sample. This was particularly important limitation in considering the findings on developmental

education, where there was a significantly smaller proportion of students in the participant sample who did significantly better on reaching the educational outcomes included in the study. This study did not provide a means of knowing if the developmental education students in the participant sample were substantively different in terms of the KSAs they brought to their studies. Nor is it possible to know how much of the change reflected in this study could be rightly attributed to the TAACCCT funding and how much was attributable to other changes at the colleges that took place over the seven year span of this study.

Summary

There are a few trends in the enrollment and educational outcomes of the underserved subgroups of students in this study. Where there were significantly more nontraditional-aged students, Pell-eligible students, and Latino students, there were significantly fewer males and students who completed developmental education in the participant sample than in the comparison sample. The changes in enrollment of males likely reflects a lack of an intentional strategy to attract male students into H2P impacted programs of study. Where the reduction in students who took developmental education likely reflects the personalized interventions provided by H2P colleges in effort to reduce students' need for developmental education.

With the exception of nontraditional-aged students, the subgroups in the study saw a gain in the odds of being retained without a credential. This may reflect that changes strategies such as introducing the HOCC may have improved students' basic skills, but in contrast to accelerating may have extended the time to completion. Without a study that can examine outcomes over a long time period, it is unclear if this delay pays off in positive outcomes over time. In the short-term however, most of the underserved subgroups saw the difference in odds

between them and their peers grow to their deficit in earning a certificate or any credential. The clear exception to this were Pell-eligible students who had gains in the difference in odds to their favor for all of the educational outcomes in this study. The positive news is that all of the subgroups, with the exception of Latino students, saw small increases in the odds that they would be awarded one or more degrees. Unfortunately, Latino student saw a large decrease in the odds that they would be awarded one or more degrees.

There are implications for theory, policy, and practice from the findings in this study. The HCT needs to be amended with a new assertion that reflects the impact of systematic inequities and discrimination. Specifically, in addition to the existing assertions of HCT, the following assertion is needed: the federal government must acknowledge existing systematic inequities, and ensure that human capital investments reach and have the intended impact for underserved and underrepresented populations. At the policy level, two changes are necessary. One is federal grants that are targeted to support underserved populations need to be a priority for federal investments. Additionally, there needs to be systematic collection of disaggregated participation and outcomes for all federal investments in education, and there needs to be support for using these data to improve outcomes for underserved populations. Finally, it is the author's honest belief that among the practitioners who made up the H2P consortium there was a commitment to improving educational equity and diversifying health professions. However, changes in educational equity require complex and sometimes transformative change to remove systematic barriers and to counter the detrimental effects of discrimination, and much work still remains to be done both within and beyond H2P. Educators need access to disaggregated outcomes and need to follow an intentional process to identify equity gaps, identify and implement potential solutions, and evaluate the interventions.

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Appendix A

H2P TAACCCT-Funded Health Professions Programs of Study

H2P TAACCCT-Funded Programs of Study	Program Length	Number of College With the Program	Number of Programs in this Study
Associates Degree Nursing	Associates degree	9	8
Associates Degree Nursing (Mobility)	Associates degree	9	8
Certified Nursing Assistant, Medical Aide, State Registered Nursing Assistant	Very short-term certificate	8	6
Clinical Lab Technician	Long-term certificate	1	1
Community Health Worker	Short-term certificate	1	0
Community Health Worker	Very short-term certificate	2	1
Community/Retail Pharmacy Assistant	Short-term certificate	2	2
Dental assisting	Long-term certificate	1	1
Electrocardiograph (EKG) Technician	Very short-term certificate	1	1
Emergency Medical Technologist (EMT) Associate's	Associates degree	2	2
EMT Basic	Very short-term certificate	4	3
EMT Intermediate	Short-term certificate	1	1
EMT Paramedic	Long-term certificate	3	2
Expanded Functional Dental Certificate	Short-term certificate	1	1
Health Science Technology	Associates degree	5	4
Health Unit Coordinator	Very short-term certificate	1	1
Limited Scope X-Ray	Short-term certificate	1	1
Long-Term Care Assistant	Short-term certificate	1	1
Massage Therapy	Long-term certificate	1	1
Medical Assisting	Associates degree	2	2

H2P TAACCCT-Funded Programs of Study	Program Length	Number of College With the Program	Number of Programs in this Study
Medical Assisting	Long-term certificate	4	4
Medical Billing	Short-term certificate	1	0
Medical Coding	Long-term certificate	1	0
Medical Coding	Short-term certificate	2	2
Medical Imaging (MRI)	Associates degree	1	1
Medical Office Administrative Assisting	Short-term certificate	1	1
Medical Office Clinical Assisting	Short-term certificate	1	1
Medical Office Radiography	Short-term certificate	1	1
Multi-Competency Health Completion	Associates degree	1	1
Orthopedic Technician	Very short-term certificate	1	1
Perioperative Nurse Internship	Associates degree	1	1
Personal Training	Short-term certificate	1	0
Pharmacy Technician	Short-term certificate	4	4
Pharmacy Technician II	Long-term certificate	3	2
Pharmacy Technology	Associates degree	1	1
Phlebotomy	Very short-term certificate	3	2
Physical therapy Assistant	Associates degree	1	1
Practical Nursing/Vocational Nursing	Long-term certificate	7	7
Respiratory Care	Associates degree	1	1
Sterile Processing Certificate	Short-term certificate	1	1
Trained Medication Aide	Very short-term certificate	2	1

Notes.

1. See Bragg et al. (2015) for full listing of H2P's TAACCCT-funded programs of study by college.
2. Not-for-credit programs of study and TAACCCT-funded programs of study at Malcolm X College were excluded from this study.